Pit and Quarry

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Ten to One . . .

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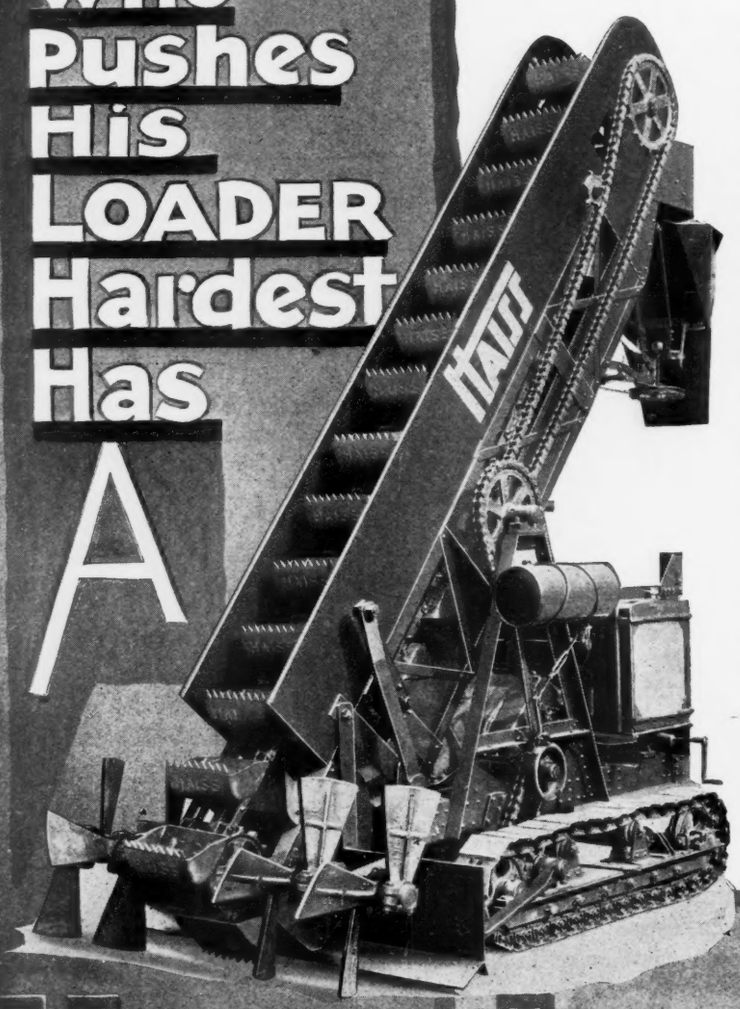

HAISS LOADER

"The Loader That Can Crowd Continuously"

Pit and Quarry

Vol. XVIII CHICAGO, ILL., JULY 31, 1929 No. 9

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is taken from our files and its selection is without significance as to current events or as to the position of the individual in the industry.

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H. J. Kaufman

President, Arrow Sand & Gravel Company

Columbus, Ohio

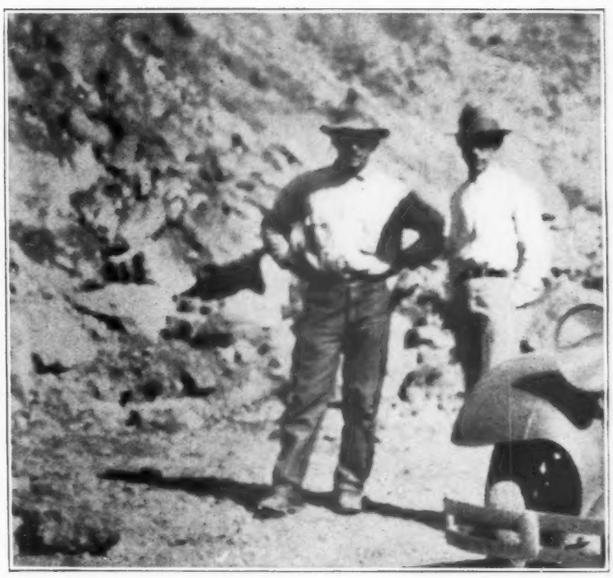
Aerial Tramways Facilitate Handling of Crushed Stone in Large California Basalt Plant

Take Rock from Crusher to Screen and from Storage to Railway and Barges

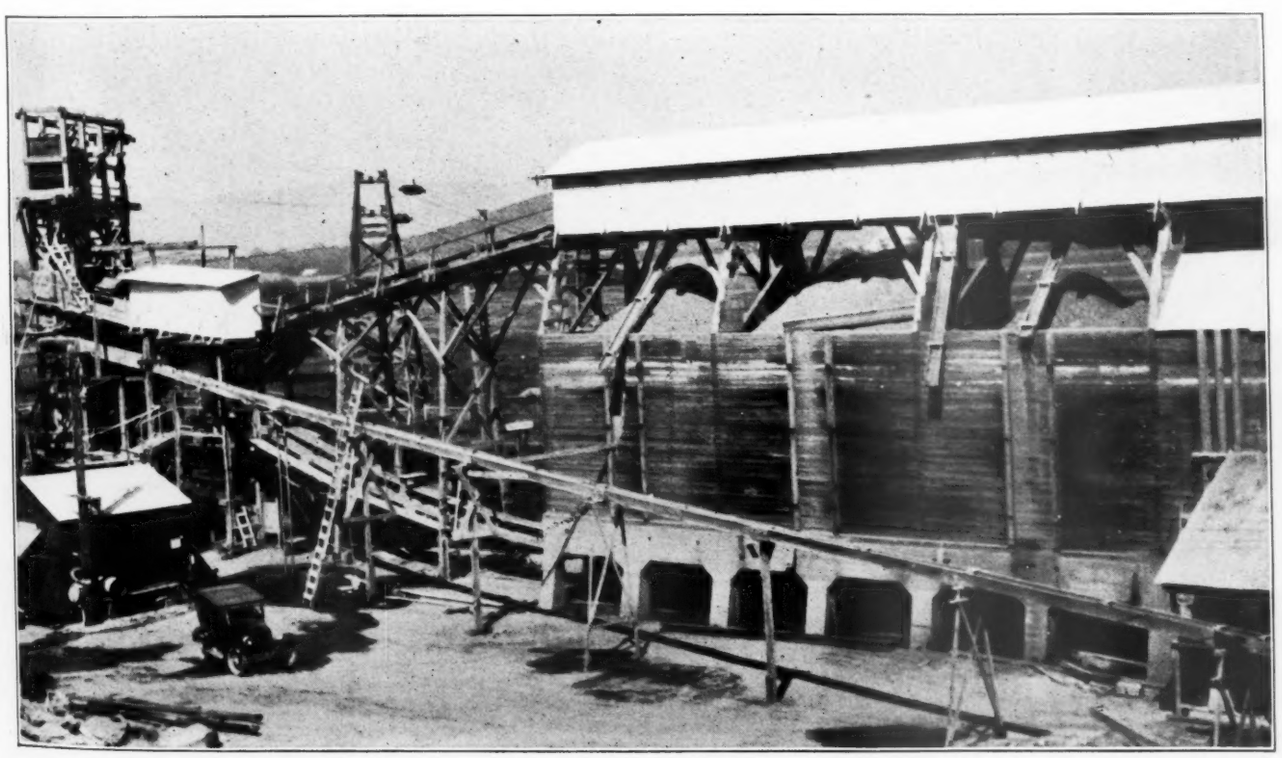
By ERNEST MOYER

THE SHIPMENT of crushed basalt over distances involving freight rates as high as $1.20 a ton and to destinations within the minimum-freight zones of competing producers is an unusual accomplishment and one that testifies to the high quality of the product transported. Yet such is the record repeatedly made by the Basalt Rock Company, whose plant near Napa, California, is producing crushed basalt rock that is exceptionally hard and dense in structure and of a dark-blue color.

About 40 miles southwest of the plant lies San Francisco; within a 50-mile radius are Oakland, Berkeley, and numerous other cities and towns; a circle of 100-mile radius includes Sacramento, Stockton, and the other populous centers of middle California. Of the three types of transportation facilities available—water, railway, and highway—the first gives access, through the navigable waters of San Francisco and San Pablo bays and the Sacramento and San Joaquin rivers, to this large territory. A branch line of the Southern Pacific Railroad serves Napa Valley, in the center of which lies Napa with its 7,000 inhabitants, and a main state highway traverses it from north to south.



Louis Cassayre, Superintendent, and A. G. Streblow, President and General Manager.



Discharge End of Tram Tower and Shipping Office at Left, Bunkers at Right.

A 1¼-yd. Electric Shovel Loading Truck in Quarry.

The face of the quarry, which is part of a property comprising 160 acres, is about 1,000 ft. in length and 130 ft. in height and is exposed to the west. In late winter and early spring, when rains are frequent and heavy and the forenoons often foggy in the Napa Valley, this western exposure makes possible a full utilization of the drying action of the afternoon sun, while the prevalence of westerly winds off the Pacific Ocean in the summer provides favorable and pleasant working conditions during the hottest months. An opening on the north side of the quarry admits the infrequent but dry winds that blow in a southerly direction.

Rock is taken from the side of one of the hills, which has a slope of about 20 deg. from the horizontal. The quarry floor, which is kept clean and smooth, lies about 100 ft. above the bottom of a ravine. Tunneling or coyote-holing is the method of blasting employed.

On April 27th, this year, approximately 40,000 cu. yd. of rock was broken down by a single blast. The main adit cut into the face was 40 ft. deep and the crosscut, or top of the letter T, was of about the same length. The blast involved three loadings, one at each end of the crosscut and one at its intersection with the main adit. Each loading was made of Trojan granular, and employed 50 lb. of 60 per cent Trojan and two electric caps. The detonation current was taken from an electric-power line.

Oversized boulders, unless too large to balance on the dipper teeth, are picked up by the shovel and stacked at the rear, where they are block-holed, care being exercised to back the shovel away when the blasts are fired.

Air for the Ingersoll-Rand Jackhamers and drill sharpener is supplied at 90-lb. pressure by a Gardner, 11-in.-by-12-in. horizontal compressor, which is belt-driven by a 50-hp. General Electric motor fitted with a paper pulley and is furnished with an air receiver 2½ ft. by 6 ft. in size. Cooling water, kept in a tank on a bank back of the galvanized-iron compressor house, is circulated by a rotary pump, direct-connected by a flexible coupling to a ½-hp. General Electric motor. The compressor, motor, and pump units are individually mounted on substantial concrete bases.

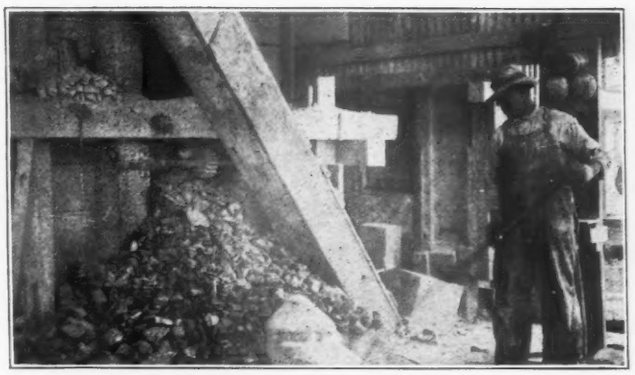
Minor repairs are made in the blacksmith shop, which is of galvanized-iron construction and situated near the compressor house. The mechanical equipment includes a coal forge fitted with an electric blower, an anvil, and an Ingersoll-Rand model 1R33 air-operated drill sharpener. Across the roadway stands a building wherein oils and grease, machinery spare parts, and two motor trucks are stored. Explosives are kept in a magazine in the side of a hill at some distance from all operations.

The quarry shovel is a Marion model 32 fitted with a 1¼-yd. dipper and mounted on crawler-type traction wheels. Its 50-hp. motor is supplied with 440-volt, a.c. current through several hundred feet of 3-strand insulated power cable, which lies on the quarry floor and is covered with heavy, asphalt-treated canvas to protect it from the danger of damage from falling rocks to which it is always exposed. Direct-connected to the shovel motor by a flexible coupling is a General Electric generator, which furnishes a.c. current for the hoist, crowd and swing motors.

Tramway Up Hill from Quarry.

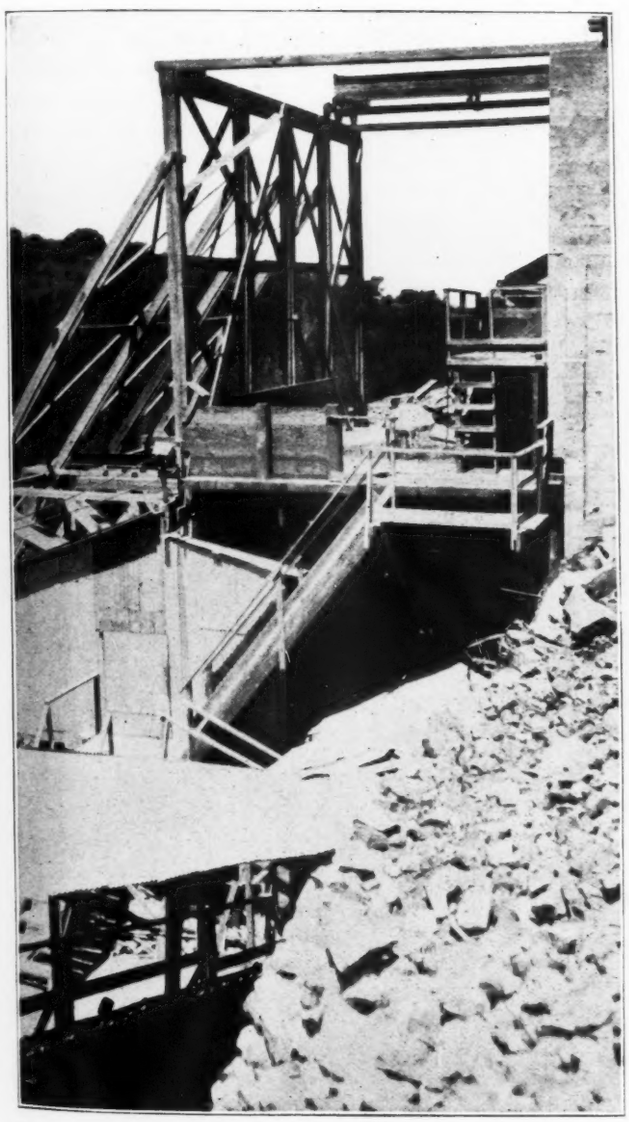
Two 5-ton Mack trucks, fitted with solid tires, haul the rock from the shovel to the primary crusher, a distance of about 1,000 ft. at present. To withstand the impact of falling rock dropped in them by the shovel, the sides, bottoms and front ends of the truck bodies are made of double steel plates separated by a filler of 2-in. planks and braced by standards of angle, channel and I-beam construction. The bodies, designed and made by the Basalt Rock Company, have outward-flaring sides on a level with the front end, which is several inches higher than the top of the driver's cab, and will hold about 7 tons of rock. No tail gates are used. Should the shovel operator overrun his swing in loading a truck, the dipper will strike the high front end of the truck body, thereby forcing the truck forward and avoiding injury to its driver.

The trucks back up to and unload into a small bunker situated above and at one side of the crusher. On the side of the bunker facing the crusher is a heavy gate, hinged at the top, which acts as a baffle to retard the speed of the rock as it falls into the crusher. Although the rock is usually crushed as each truck load is discharged, a supply can be allowed to accumulate in the bunker by closing the gate.



One of the Two Reduction Crushers and Feed Bunker.

Resting on the bottom of the gate opening and rising at an angle of 45 deg. to the opposite side of the bunker is a rail grizzly spaced 3 inches. Material passed through the grizzly is stored in a section of the bunker directly below it and is fed to a conveyor through a gate operated by the crusher attendant from the crusher platform. Rock rejected by the grizzly passes through the aforementioned baffle gate into the primary crusher, which breaks it to 4 in. minus and discharges toward the feed bunker.



Traveling Crane Over Primary Crusher. Conveyor to Tramway Lower Left.

The primary crusher is a 30-in. Traylor bulldog gyratory machine, installed in November, 1928, and driven by a 300-hp. General Electric motor, the shaft of which extends beyond the 52-in. pulley and runs in an outboard bearing. A Bodinson Climax short-center belt drive maintains not less than 200 deg. of arc contact between the 22-inch belt and the motor pulley, the distance from the motor-shaft center to the crusher-shaft center being approximately 6 feet. Massive concrete bases support the crusher, the motor, and the belt drive. Crusher parts are handled by a 20-ton traveling crane of Bodinson manufacture mounted on timbering above the crusher.

The present quarry-floor level is about 50 ft. above the top of the crusher, to which point the floor will eventually be lowered by further operations. This deepening of the quarry will open a number of new ledges of particularly fine rock and increase the quarry yardage considerably.

Rock issuing from the primary crusher and the feed bunker falls on a 160-ft. center-to-center conveyor, which is made of 30-in. belting and has a general rise of 19 deg. and one of 5 deg. at the loading end, and is driven by a 30-hp. General Electric motor. The troughing rolls are Alemite-lubricated, all other bearings having grease cups. The discharge end of the conveyor empties into the 100-yd. tramway-loading bunker, which is fitted on its under side with a large, undercut quadrant gate

Feed End of Cone Crusher.

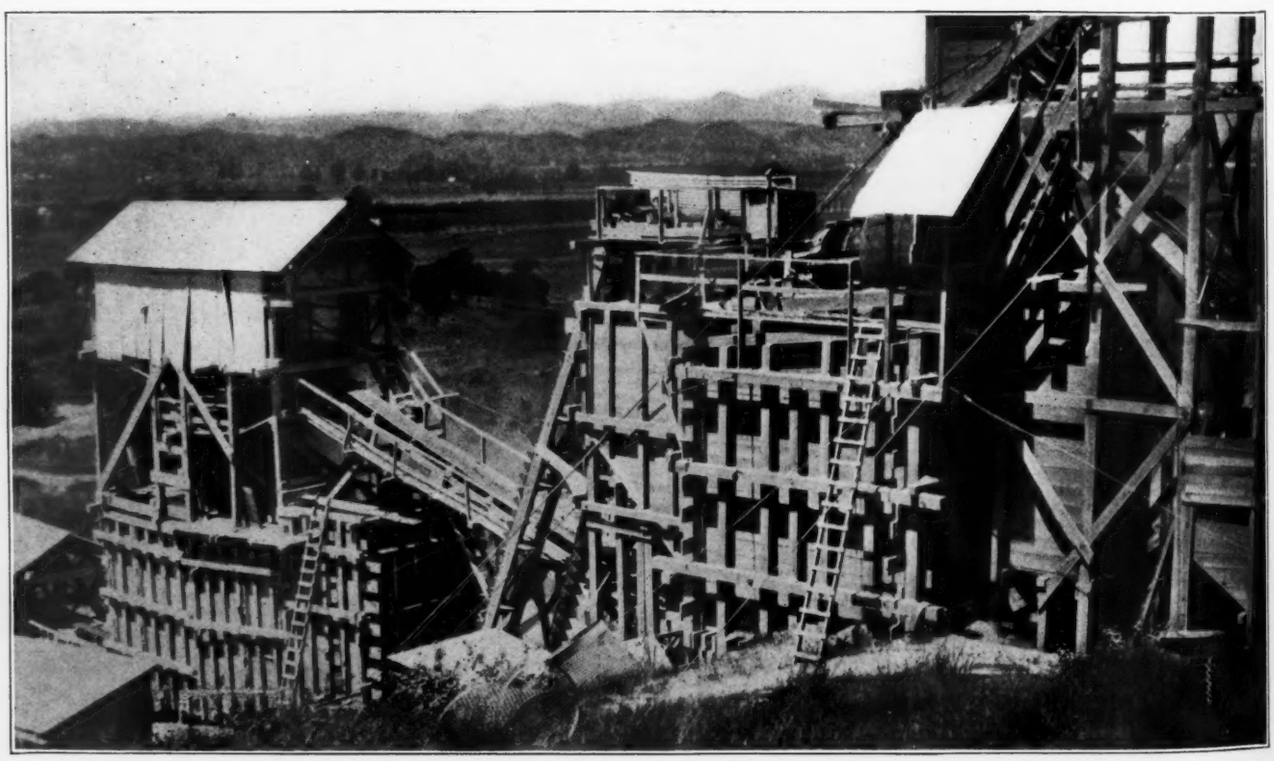
provided with a long lever to facilitate operation. Through this gate material is dropped into a hopper having a capacity equal to that of one tramcar. As each car passes under this hopper it trips the hopper latch, releasing the side facing the direction of car travel and discharging a hopper load into it. After a car has passed suitable counterweights close the hopper side and latch the locks. The quadrant-gate operator then refills the hopper and the operation is completed when the next tramcar arrives.

As the tramway is now set, with regard to speed and the distance between the cars, its capacity is 120 cu. yd. per hour. At the discharging end of the tramway—furnished with erection instructions by the Interstate Equipment Company of New York—is the driving and braking mechanism, all under control of the gate operator, who has a telephone interconnected with the other plant units to keep him informed of required changes in the delivery schedule.

The tramway, which has a center-to-center length of 3,000 ft., crosses the top of the hill opposite the quarry, rising approximately 200 ft. and falling on the far side of the hill to a level considerably lower. When all the cars are loaded, the tramway operates by the force of gravitation and a powerful braking mechanism is required to stop it. At other times it is belt-driven by a 25-hp. General Electric variable-speed motor through a countershaft, the pinion of which drives the gear of the head shaft, on which is keyed the head sheave fitted with automatic clutch dogs that grip the traction cable as it winds on the sheave and release it as it leaves the sheave. A large-diameter brake-drum, fitted with a band brake controlled by the operator, is keyed on one end of the head shaft.

At the discharge end of the tramway from the quarry is the secondary-crushing, sizing, and storage section. This installation was carefully laid out, utilizing the topography of the ground on which it is situated. On a bluff at the side of a ravine are the crusher and screen installations and just below and beyond these, where the ravine opens out on nearly level land, is the storage. The tramway discharges at the top of a 60-foot tower through a chute into a Bodinson 4-ft.-by-8-ft. rotary scalping screen, mounted on the top of the reduction-crusher feed bunker and driven by a 7½-hp. General Electric motor.

The main section of this screen has 1½-in. holes,

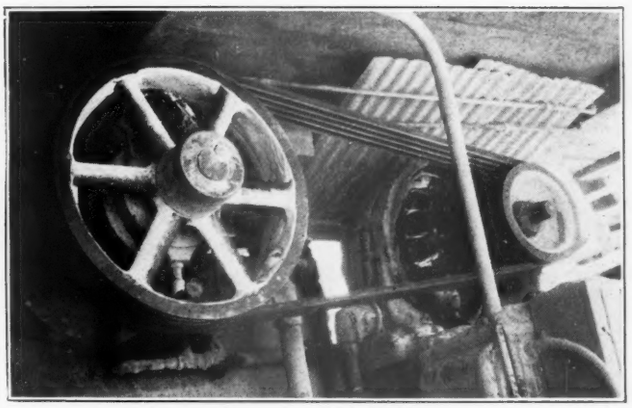


Vibrating Screens and Segregation Bunkers, Left; Reject Elevators, Scalping Screen and Secondary Feed Bunker, Right.

while the 6-ft. diameter jacket has ¾-in. holes. The ¾-in. "throughs" are chuted on to a 12-in. conveyor, which has 150-ft. centers, a 9 deg. rise, and is driven by a 10-hp. motor. This material contains practically all the overburden dirt and rock coatings and is stacked as waste to be reclaimed later and sold for road coating and railroad ballast. Although in considerable demand and marketable, this is referred to as waste. All the remaining rock, ¾-in. and larger, is clean and hard. The 1½-in.-by-¾-in. "throughs" from the scalping screen and the "rejects" from the ¾-in. jacket are chuted either to the main storage conveyor or to the reduction crusher, according to the size of rock being made. The "rejects" from the 1½-in. section fall into the first compartment of the reduction-crusher feed bunker.

Below and at one side of this bunker are two Telsmith F3 reduction crushers. The rock is fed from the bunker through a rack-and-pinion gate to each crusher. One crusher is belt-driven by a 50-hp. General Electric motor, the other by a 50-hp. Fairbanks-Morse ball-bearing motor. Both motor pulleys are of paper.

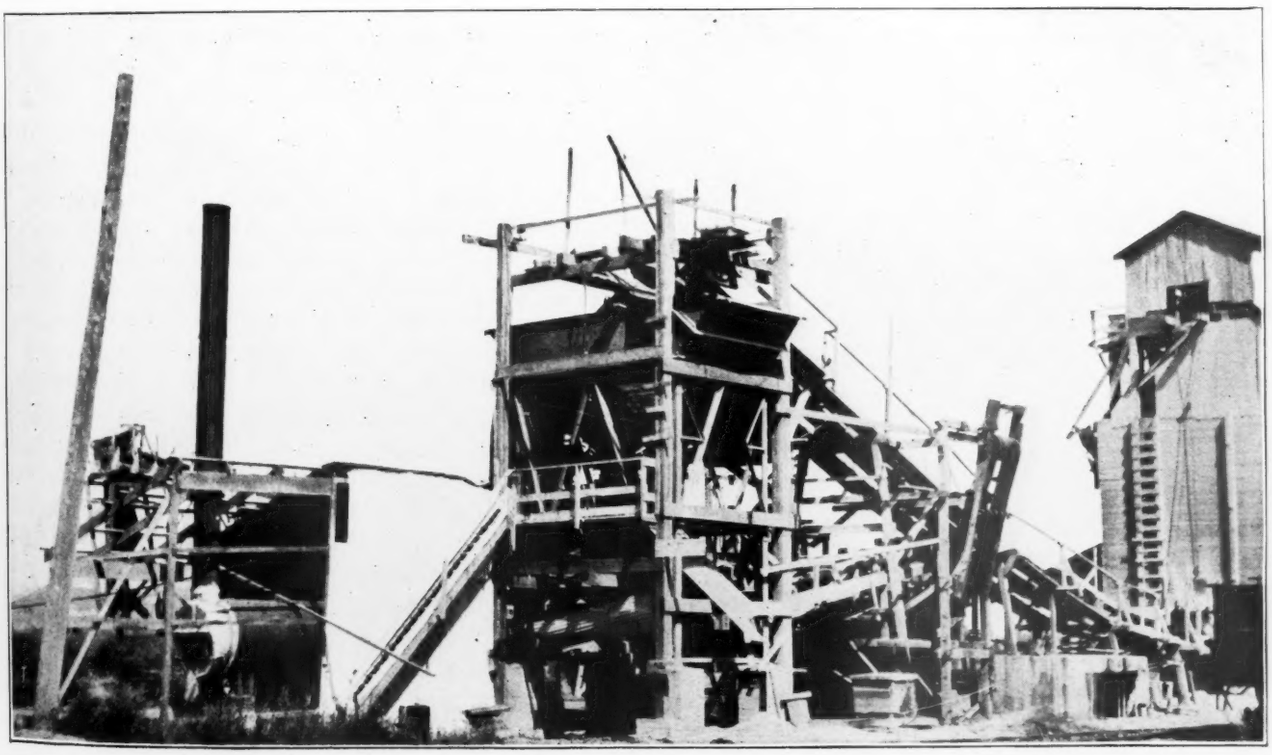
Underneath these crushers and rising at a slope of 17 deg. is a 36-in. conveyor on 120-ft. centers, driven by a 15-hp. General Electric motor and discharging at the top of a battery of sizing screens. This battery comprises two 3-ft.-by-4-ft. Hum-mers set in tandem at an angle of 33 deg.; one 3-ft.-by-4-ft. Hum-mer set on an angle of 25 deg.; and one 3-ft.-by-6-ft. Simplicity screen set on an angle of 17 deg.; each vibrated by individual-motor drive. All screens are double-deck. At the time of



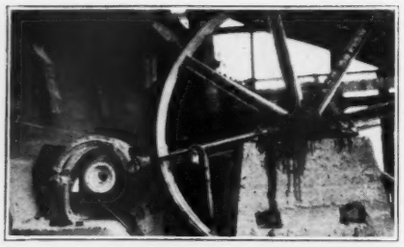
Drive of Cone Crusher.

securing these data the screen trays included the following: Tandem Hum-mers, top deck, 1-in. mesh, bottom deck ½-in.; third Hum-mer, top deck ¼-in., bottom deck ⅛-in.; Simplicity, top deck 1½-in., bottom deck ½-in. Alternating current at 110 volts for the Hum-mer screens is supplied by a generator direct-connected to and driven through a flexible coupling by a 5-hp. 3-phase 440-volt motor. Six sizes of material besides the ¾-in. minus waste were being made.

Segregation into the six bunker compartments is made as follows. The conveyor discharges on to the upper end of the upper Hum-mer tandem. The oversize from the tandem top decks—the 1-in. plus—feeds to the Simplicity top deck, and the "rejects" off this top deck—the 1½-in. plus—go into the first compartment of the bunker. The "rejects" from the Simplicity lower deck—the ½-in. to 1-in.—go into the second compartment. The

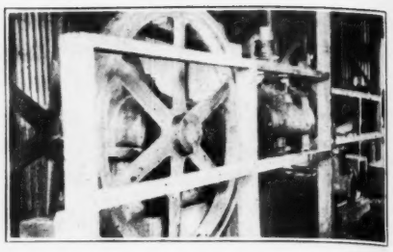


Oil-mix Plant, Two-Compartment Steel Bunker and Hinged Loading Conveyor.



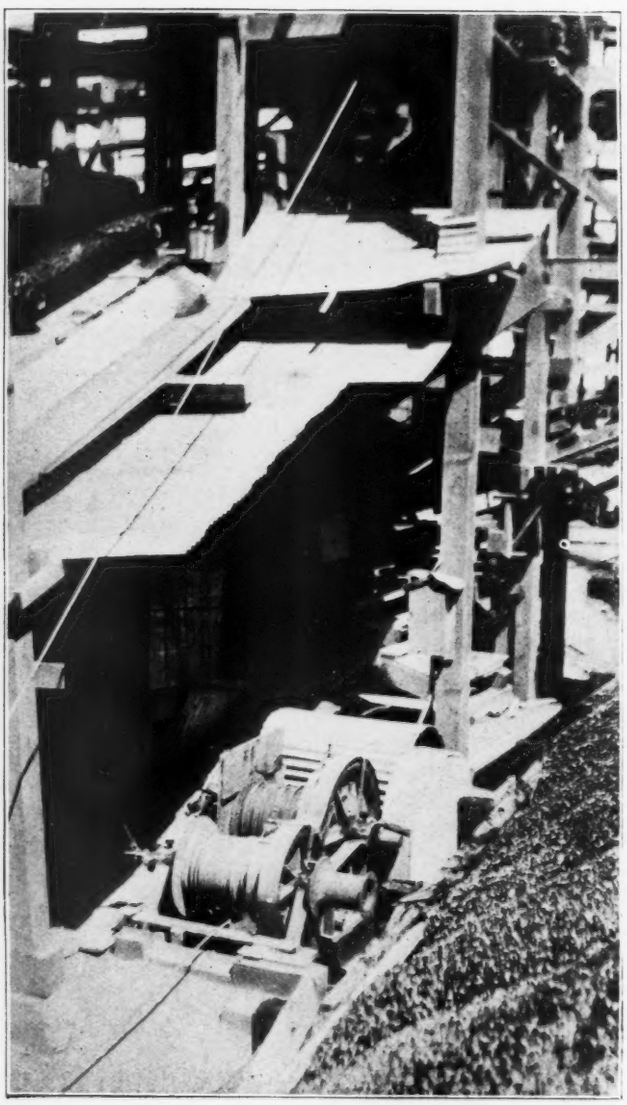
Type of Drive on Clutch Pulley Driving Ball Mill.

One of the Vibrating Screens, Motor and Drive.



The Compressor Which Furnishes Air for Jackhammers.

"throughs" of the Simplicity lower deck — the 1-in. to ½-in.—go to the third compartment. The oversizes or "rejects" from the Hum-mer lower deck—the 1-in. to ½-in.—also go to the third compartment, while the "throughs"—the ½-in. minus —drop on to a chute below and go to the third Hum-mer, which faces in the opposite direction. The "rejects" from this top deck—the ½-in. to ¼-in.—go to the fourth compartment, while those from the lower deck—the ¼-in. to ⅛-in.—go into the fifth compartment. The "throughs" from this lower deck—the ⅛-in. to dust—go to the sixth compartment.

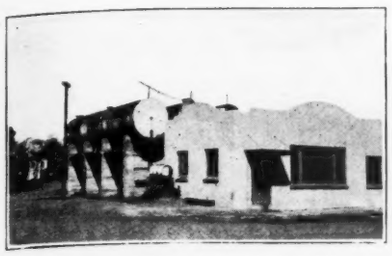


The Two-drum Car Puller.

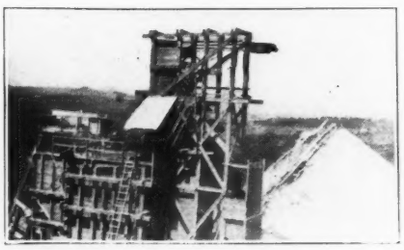
Underneath the six-compartment bunker, and extending outward to utilize level ground at the foot of the ravine, is the 24-in. storage conveyor, 550-ft. centers, level, supported by a trestle and driven by a 20-hp. General Electric motor. Tension is maintained by a vertical gravity take-up. The height from the ground level to the conveyor is 50 feet. A Bodinson self-propelled 24-in. tripper discharges the various sizes of rock to their respective stacks. Each compartment of the bunker holds sufficient material for several hours' run. About 50 ft. beyond the bunker, at a horizontal angle of about 60 deg. from the main storage conveyor and fed by it, is a 24-in. auxiliary storage conveyor, having 70-ft. centers and a 9-deg. rise, used to stack an additional pile of ½-in. to 1-in. rock. The 150-ft. conveyor for waste, previously described, is at right angles to the bunker and storage conveyor.

The storage layout thus resembles the letter L, with the waste and additional stack forming the short leg. There is considerable sale for a 1-in. minus road rock, so, by proportioning the ¾-in. minus waste and the ½-in. to 1-in. sizes, this demand is readily supplied.

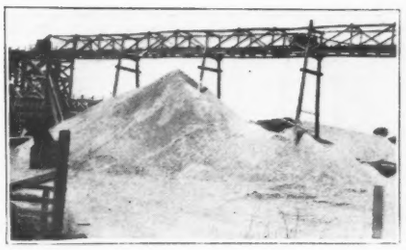
Thus far, the only reduction crushers noted are the two Telsmiths, which produce about 1¾-in. minus rock. At times this is not a sufficient reduction and to obtain greater reduction a Traylor No. 4½ reduction crusher and a 3-ft. Symons cone crusher are mounted in line with and discharge on to the same conveyor running from the Telsmiths to the screens. The Symons crusher is driven by a 60-hp. Fairbanks-Morse ball-bearing motor through a Tex-rope drive. It is fed from a separate compartment of the reduction-crusher feed bunker partially supplied, when desired, by the ¾-in. to 1½-in. "rejects" from the scalping-screen jacket. The main supply is from compartments 1, 2, and 3 of the bunker. Beneath these compartments, fed by separate gates, paralleling the main-storage conveyor, but facing and running in the opposite direction, is a 24-in. conveyor with 26-ft. centers and a 4-deg. rise, which discharges into an elevator having 65-ft. centers and a slope of 62 deg., which in turn discharges, through a chute with a



Office and Oil Tanks at Eighth Street, Napa, California



Discharge End of Tramway; Waste Pile and Conveyor at Right.



Section of Storage Conveyor with Tripper Discharge.

quantity-control adjustment, into the compartment that feeds the cone crusher. This arrangement, in connection with the ease of adjusting this crusher for varying sizes of product, proves very flexible and satisfactory.

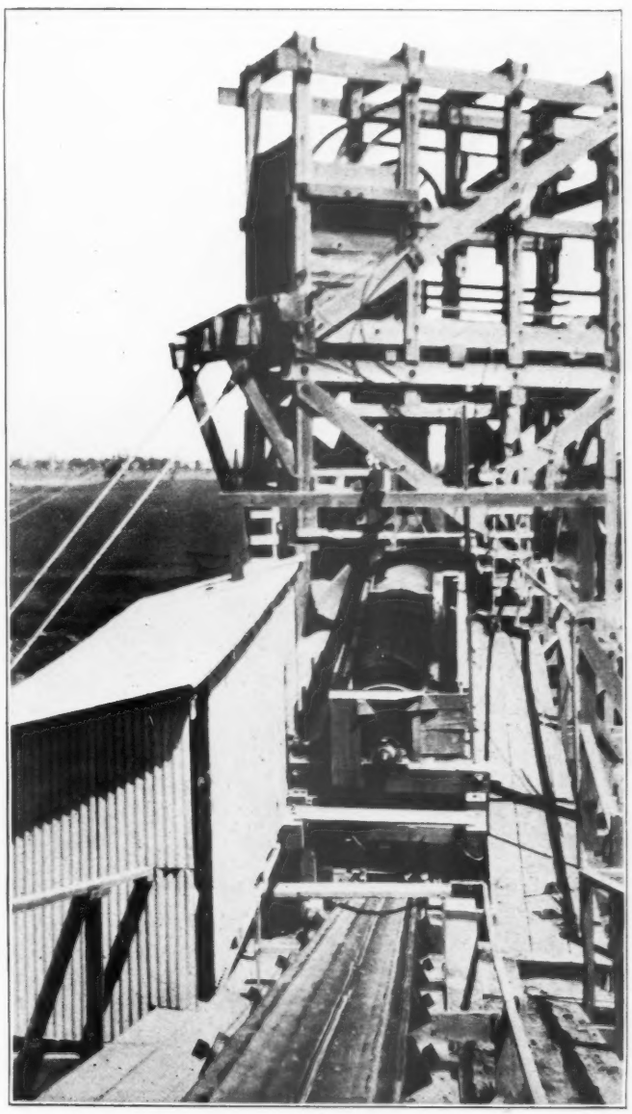
The conveyor is driven by a 5-hp. General Electric motor and the elevator by a 15-hp. motor of the same make.

The Traylor reduction crusher is fed either from the Telsmith or the cone-feed bunkers, or with the ¾-in. to 1½-in. "rejects" from the scalping screen.

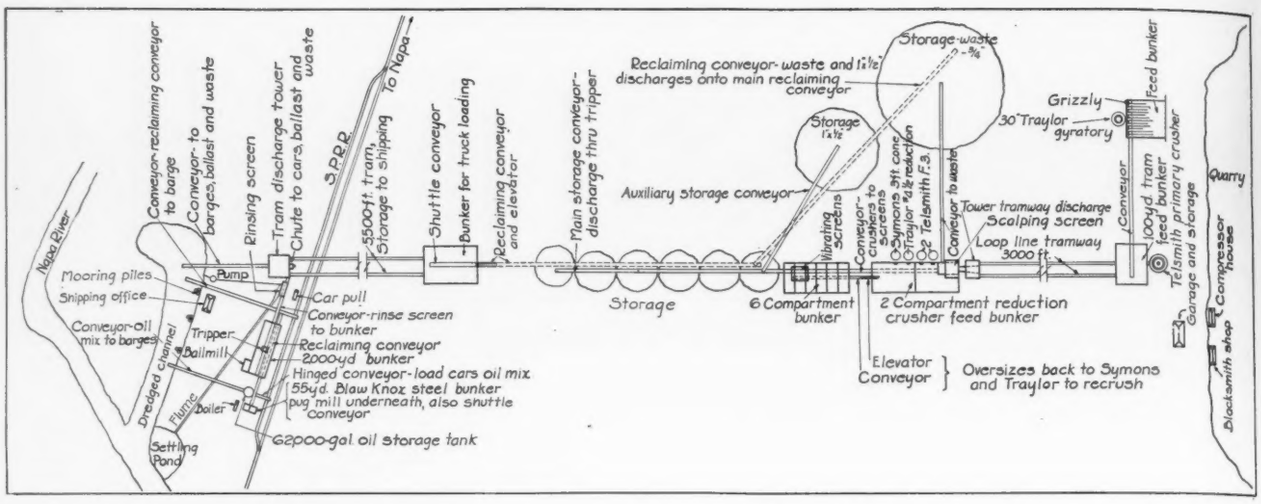
Underneath the storage stacks, below ground level, in a concrete tunnel is a 24-in., 525-ft.-centers reclaiming conveyor, level, driven by a 15-hp. motor. Spaced at 10-ft. centers in the roof of the tunnel are the conveyor feed gates. At the tail end of this conveyor and discharging on to it is another 24-in. conveyor on 150-ft. centers, having a 2-deg. slope downward toward the discharge end and driven by a 5-hp. motor. This conveyor, also in the tunnel, is fed by gates in the roof and reclaims from the waste and additional 1-in. to ½-in. stack. The angle of this conveyor from the main reclaiming conveyor is such as to reclaim the largest amount possible without rehandling from the two storage stacks.

The main reclaiming conveyor discharges direct into a 65-ft. elevator which in turn discharges on to a 24-in.-by-33-ft. horizontal shuttle conveyor driven by an individual motor and mounted on the top of a 200-cu.yd. five-compartment bunker. This shuttle conveyor discharges into any of these compartments as desired. Driveways for trucks are provided underneath and the trucks are loaded from lever-operated, sliding gates in the floor of the bunkers. A loop-line tramway—identical with that from the quarry, except that its motor is of 40 hp., that its length is 5,500 feet and that it travels over practically level country—is loaded from the compartment at the end of the bunker and delivers to the channel shore and railroad section of the shipping plant. This tramway crosses the state highway, electric railroad tracks and, at the discharge end, the tracks of the Southern Pacific Lines.

The layout of the rinsing, shipping and oil-mix unit parallels the tracks of the Southern Pacific Lines and is between them and a channel about 1,000 ft. long, dredged by the Basalt company from the Napa River to the loading docks of the plant. The tramway discharges at an elevation of about 60 ft. into a hopper or chute having a three-way discharge. One outlet feeds a long-swing chute hinged at the top to the tram tower and used to load cars with material, particularly the waste road rock and ballast direct from the tram. The second outlet feeds a horizontal conveyor, discharging into a swing chute at the dock to load the same material into barges. At right angles to these outlets and



Tram Discharge with Rinsing Screen and Conveyor to Bunkers in Foreground



Plan of Basalt Rock Company's Plant at Napa, California. Note Facilities for Shipment by Boat and Rail.

facing the bunkers is the third outlet, feeding a 24-in.-by-195-ft. conveyor driven by a 15-hp. motor. The first half of this conveyor rises at a 15 deg. angle, the remainder over the bunkers being level.

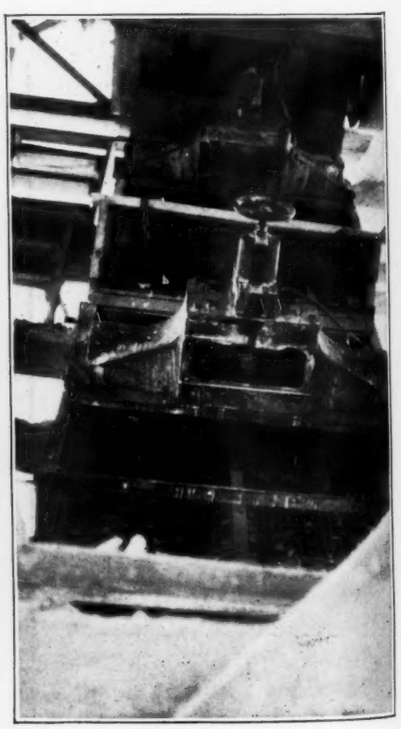
Above this last conveyor at the tail end is a Bodinson 42-in.-by-16-ft. rotary rinsing screen, the first 6 ft. of which is blank while the balance is of 1/16-in. mesh. This is fed by a chute from the third tram outlet. A hinged gate in the outlet closes the chute to the screen and feeds direct to the conveyor. In its opposite position it closes to the conveyor and feeds direct to the screen, which is belt-driven by a 15-hp. Fairbanks-Morse ball-bearing motor. The screen speed of 20 r.p.m. rapidly rolls the rock, exposing it thoroughly to the rinsing action of the water jets.

As noted before, waste and "fines" are removed at the sizing plant, thus leaving only a thin film of dust to be rinsed from the rock. The water containing this dust is flumed from the screen to a settling pond some distance away. The rinsed rock feeds to the conveyor underneath, is carried to the top of the bunker, and discharges through a Bodinson hand-propelled tripper, one position of which feeds a swing chute from the railroad side of the bunker whereby cars are frequently loaded direct. Other positions of the tripper feed the several bunker compartments. At each of these positions water under pressure is provided and jetted against the rock, if additional rinsing be required.

Underneath the bunkers and fed by gates in the bottom of them is the reclaiming conveyor, 30 in.

Measuring Batchers Under Bunkers; Pug-Mill Drive Below.

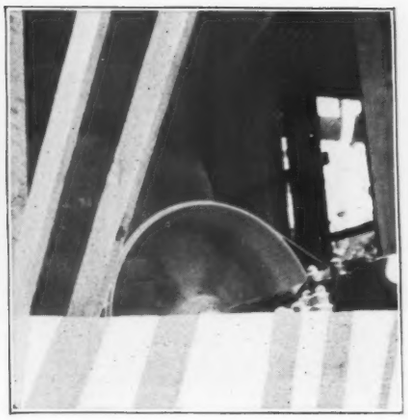
Tramway Head Sheave, One of Rails and Car Above.



The Tandem Vibrating Screens Over the Storage Bunkers.

Short-Center Belt Drive for Conveyor.

Ball Mill Beside Storage Bunker.



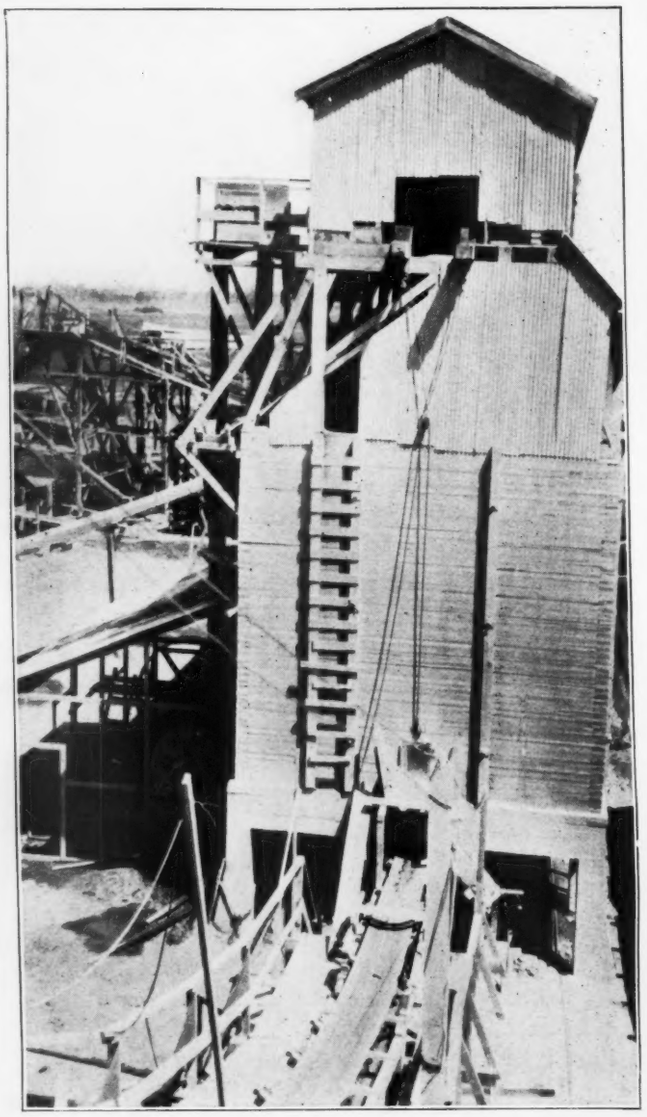
Primary Crusher and Drive Pulley.

by 150 ft., level under the bunkers, then for 50 ft. on a 19-deg. rise to the head pulley which is driven by a 15-hp. motor. Here the rock discharges into a hopper, one chute of which feeds an 83-ft. conveyor on a 19-deg. rise, at right angles to the reclaiming conveyor. Discharge is into a long swing chute, into which a jet of rinsing water can be turned. Shallow-draft vessels, usually barges, are loaded by this arrangement at the rate of about 250 yd. per hour.

Discharging in a direction opposite to that of this conveyor is a 22-ft.-centers inclined conveyor for loading cars. This is of the shuttle type to provide locomotive clearance. A jet of rinsing water can be played on this discharge. This conveyor is fed by another chute from the reclaiming-conveyor hopper. A hinged gate in the hopper controls the feed from the chute to either the barge or the car-loading conveyors. These loading units are at the end of the bunker facing the tramway tower and screen. A 4-in. Price ball-bearing centrifugal pump, direct-connected to and driven through a flexible coupling by a 15-hp. General Electric motor, supplies water for rinsing. From this description the rinsing operations appear to be complicated, but they are not so in practice. The carloads and barge loads of accurately-sized rock thoroughly rinsed to bring out the rich, deep-blue color are attractive.

The 2,000-yd. bunker is of particularly substantial construction. Concrete piers, measuring 10 ft. both across and lengthwise, support the concrete bottom. The lower 3 ft. of the sides and ends also are concrete. Embedded in the walls at the floor level are short pipes, which drain all the rinsing water that is turned into the bunker. Above the concrete the walls, ends and partitions are of 2-in.-

Dredged Channel with Belt Conveyor Loading Through Spout into Barges.



Storage Bunker with Conveyor to Oil Mix in Foreground, Ball Mill at Left.

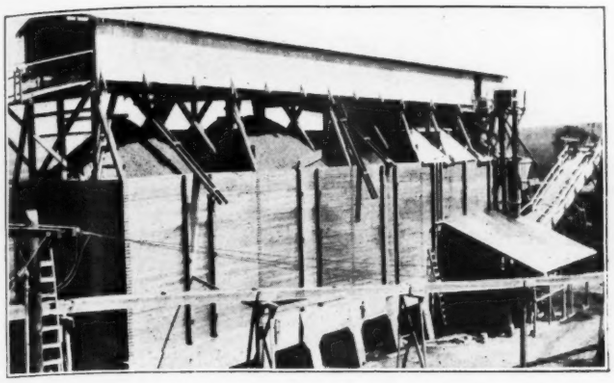
by-6-in. Oregon pine, laid flat, and spiked. The corners are cribbed as are also the ends of the partitions into the sides.

The rinsing screen and conveyors are at the north end of the bunker, while at the south end is the oil-mix unit. A Blaw-Knox 55-yd. two-compartment steel bunker is erected on concrete foundations. A 24-in.-by-95-ft. reclaiming conveyor, fed from gates underneath the compartments at the south end, discharges into the Blaw-Knox bunker, under which are the two measuring batchers with gates controlled by the operator through a hand wheel. Oil for each batch is measured by weight. The control valves, scale, and dial reading are at the operator's left.

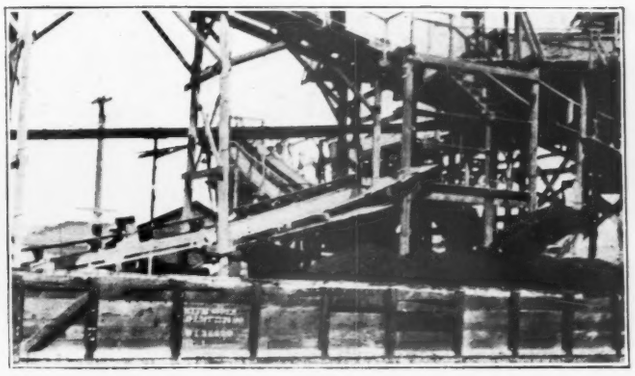
Under the batchers is the pug-mill or mixer, manufactured by the Geiger Iron Works. Into this the operator dumps the oil and the contents of both batchers. Sixty per cent of the rock is usually ¼-in. minus, a considerable proportion of this being dust, about 15 per cent passing 200 mesh; the remaining 40 per cent is ¼ in. to 1 in. in size. The oil, of heavy asphaltic content, is heated to 180 degrees. The pug-mill, which has a capacity of about 40 cu. yd. per hr., is driven by a roller chain from a countershaft which is belt-driven by a 50-hp. motor. Discharge is on to a shuttle conveyor of 30-ft. centers, which, according to the position at which it is set, discharges either on to a short conveyor at right angles to it for car loading and hinged so it can be raised for locomotive clearance, or on to a conveyor discharging into a long swinging chute above the mooring piles for loading the barges.

As this oil mix is destructive of rubber—both because of the heat and the oil content—these three conveyor belts are of canvas. Considerable difficulty was encountered at first from the heat causing the belts to stretch, while the mix, being somewhat sticky, did not discharge cleanly. These difficulties were overcome by turning a jet of steam underneath the loaded section of the belt. It was found that the moisture which the fabric absorbed

Harold Benton, Superintendent, Washing, Oil-Mix, and Shipping Section.



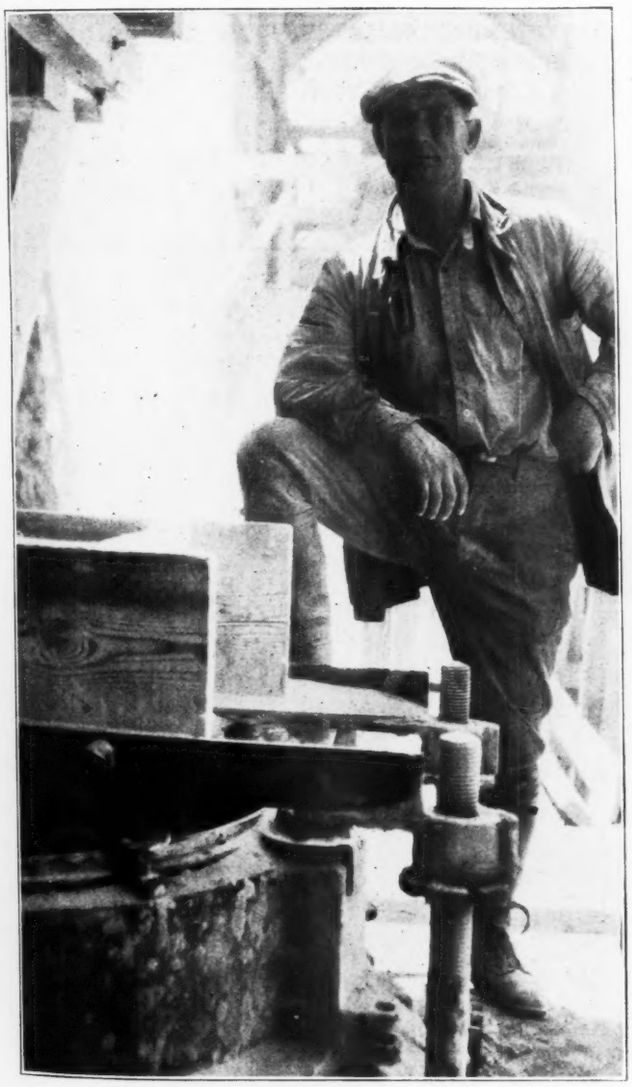
Storage Bunker with Ball Mill and Conveyor to Oil-Mix at Right.



Shuttle Conveyor Loading Cars; Conveyor to Dock in Background.

from the steam not only prevents stretch but also causes a cleaner discharge.

When trucks are loaded direct from the pug-mill, the shuttle conveyor is backed up its track out of the way. A shallow concreted excavation, underneath the mill and brought to the ground level on an easy grade, provides head room for the trucks, which are backed in for loading.



Richard Vitala, Superintendent, Secondary-Crushing, Sizing, and Storage Section.

Steam at 90-lb. pressure for heating is generated in a 150-hp. locomotive-type boiler. A small rotary pump supplies oil for both the mix and the boiler firebox. A Connersville 3-in. positive low-pressure blower supplies the air for the low-pressure oil burner. A fine stream of oil is so thoroughly atomized that the fire burns cleanly and without smoke. Between the bunkers is the 62,000-gal. concrete oil-storage tank. This can be filled from either the towers or the barge. Rock "fines" and the dust from storage are not sufficient to supply the oil mix, so at the south side of the main bunker is installed a Hendy ball-mill. This is fed direct from the bunker and discharges into a vertical bucket elevator which, in turn, discharges into the dust compartment of the bunker. The ball-mill is driven by a 40-hp. General Electric motor. Mounted on the ball-mill countershaft, and driving it through a lever-operated clutch, is a Plamondon 108-in.-by-15-in. cast-iron pulley. The countershaft and motor shaft centers are about 7 ft. apart. The tension and maximum arc of belt contact are maintained by a Bodinson No. 2 Climax short-center belt-drive.

Between the bunker and the main railroad tracks are two sidings, each about 1,000 ft. long and owned by the rock company. At the north end of the bunker, paralleling the railroad siding, is the car-pull hoist. This is a standard Norris K. Davis, two-drum hoist, gear-driven by a 30-hp. motor. One end of a 13/16-in. wire rope, 2,300 ft. long, top-wound on the front drum, extends along the siding to the south end of it, around through the sheave and back along the siding to the north end, through a sheave and back under the motor end of the hoist, this end being bottom-wound on the rear drum. A length of chain, both ends attached to the cable about midway, forms a U-loop. Placing this loop over the end of a car axle, cars can be pulled in either direction.

Except for the conveyor from the primary crusher, all conveyor and elevator lubrication is by grease cups. All elevators are belt-driven. The conveyors are either belt-driven or gear-driven through rawhide pinions. The 525-ft. storage con-

(*Continued on Page* 55)

Why Do Men Quit Work? Intelligent Investigation of Working Conditions Gives the Answer

Labor Turnover Can Be Reduced Only Through a Careful Analysis of Employee Discontent

By J. J. BERLINER

MANY ARTICLES have been written on the subject of turnover, and perhaps more on how to calculate it, and the remedies and preventive measures suggested are legion. While most of them give full details as to the remedies and their application, this article deals primarily with the classification and analysis of the causes. No attempt will be made to show methods of calculating labor turnover as the writer finds that every employment manager can do that.

The initial step of a separation from the force is when the "leaving card" is made out in a department for transmission to the employment office, and the basis of this classification is the information that is listed at the time of the separation. Much has been said in the past regarding the securing of the true reason for separations, and in many companies the right to "fire" rests with the employment manager, who is responsible for a correct portrayal of the reason for leaving; the foreman merely transmitting the information that he has no further use for the worker in question for the reason stated. It then becomes the employment manager's duty to investigate the case and endeavor to place the worker, if conditions warrant it, where he will fit in harmoniously with his surroundings.

The leaving card illustrated in Fig. 1 is filled in by the foreman to indicate that the separation is one of three classes, namely, "discharged," "laid off," or "quit." He also indicates, in the space provided, whether the employee is qualified for re-employment or reassignment, qualified for re-employment only on reassignment, not qualified for re-employment or reassignment, the reason for separation, pay data, and any pertinent remarks.

On presentation of the card to the employment office the case should be investigated and, if the

B C A B C A B C

Discharged Laid Off Quit

Leaving Card

To Employment Manager: _____ 192____

The Bearer _____ Clock No. _____

_____ Department, Worked as _____

from _____ to _____

is qualified as indicated. Reasons for leaving: _____

	A	B	C
Discharged			
Laid off			
Quit			

_____

_____

_____

_____

Asst. Supt. or Foreman.

Employment Office Record

Interviewed _____ Reassigned to _____ Department

Released _____

Received { Locker key _____ / Pass Tag _____ / Uniform _____ }

Shortages _____

_____

_____

_____

Employment Manager.

Preferment Card

The Bearer _____ 192____ Clock No. _____

has been in our employ as _____ Department since _____

He is a class _____ worker and will be given preference over new applicants upon resumption of activity.

_____

Employment Manager

Order for Wages

To Paymaster: _____ 192____

The Bearer _____ Clock No. _____

leaves our employ effective _____ 192____

Deductions for _____

(If none, so state.)

_____

Employment Manager.

Fig. 1. The "Leaving Card" Is Filled Out by the Foreman and Goes to the Employment Manager for His Investigation. The "Preferment Card" Is Attached and Given to Desirable Employees Only.

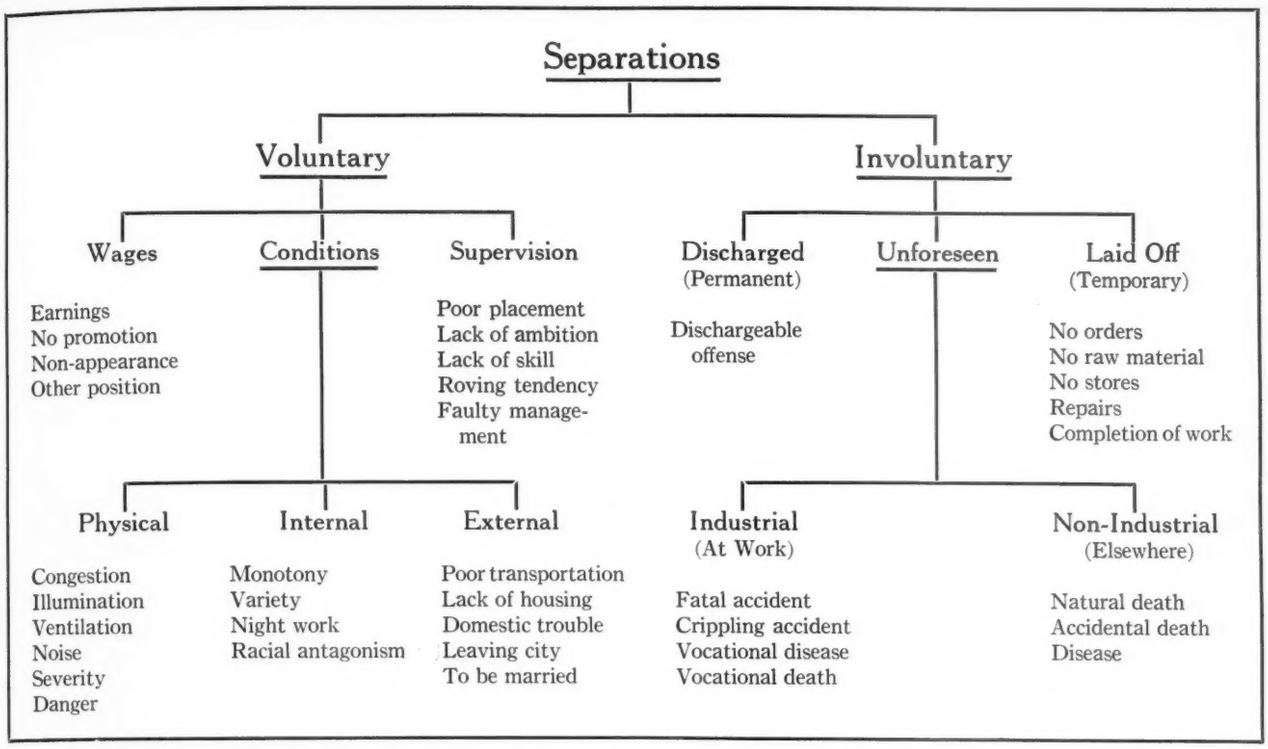


Fig. 2. This Chart Insures a Uniform Analysis of the Causes for Leaving, as Taken from the "Leaving Cards," and Serves as a Guide for Filling Out the Report Shown in Fig. 3.

employee cannot be reassigned, the true reason for leaving is entered upon the card by the employment manager, who then checks the company property charged to the employee, countersigns and detaches the order for wages due, and, in the case of a lay-off of a desirable employee (Class A), gives the worker the preferment card with an explanation of its value. Preferment cards are not given to Class C employees, but are destroyed at the time the leaving card is filed alphabetically with the record card of the employee. An index tab of a distinctive color is used to indicate the occupation of the worker or the department suffering the loss. The position of this tab indicates the nature of the separation and the desirability of rehiring the worker.

To insure a uniform analysis of the causes for leaving, as taken from the leaving cards, the chart, Fig. 2, with its explanation, is used.

In making the classifications presented herewith, an attempt has been made to analyze the causes from the employee's viewpoint and at the same time to group them so that remedial measures may be more readily applied. Assuming that each time there is a separation from the company the movement is initiated by either the employee or the management, while both parties may be mutually agreed that a separation is advisable, and in some cases highly desirable, one or the other must make the first move. This gives us our first division, which may be classed as "involuntary," where the management causes the separation, and "voluntary," where the worker expresses his desire to sever connections. The involuntary separations are divided into three classes: "discharged," "unforeseen," and "laid off."

Involuntary Separations

Under the "discharged" heading should be inserted all separations where the employee is discharged for cause, and in the chart there are no reasons assigned. As to what constitutes a dischargeable offense, this differs with each industry. For example, the first offense of smoking would merit instant dismissal in the powder or fireworks industry, yet would only merit a rebuke in a machine shop or a foundry. The company rule book, if extant, would furnish the best guide for filling in the spaces under this heading. All separations, however, that are so classed should be of the "do not hire again" variety.

The heading "unforeseen" is chosen rather than "accident," as it is intended to embrace separations arising from sickness and death due to natural causes as well as those occurring in connection with the industry, and, for this reason, it is subdivided into "industrial" and "non-industrial." Under "industrial" should be classed all involuntary separations that are caused by fatal or incapacitating accidents, by vocational or occupational disease, or by illness. Under the "non-industrial" heading should be shown all causes of an unfore-

seen nature, which may be summarized as natural death, accidental death not occurring while in pursuit of regular vocation, and incapacitating disease not contracted from industry.

In the majority of cases seasonal work or business fluctuations are largely responsible for separations chargeable to the "laid-off" heading. These include lack of orders, lack of raw material, lack of supplies, temporary shutdown for repairs, and, in the case of construction work, the completion of the job. In the case of a seasonal product, when the worker faces a protracted period of part-time work and leaves voluntarily, giving as his reason the reduction of weekly income, inasmuch as we are grouping reasons according to corrective measures, this class of "quit" should be considered as an involuntary separation, under "laid off."

Voluntary Separations

The reasons for "voluntary" separations from employment are legion, and they are first arbitrarily grouped into three subdivisions, namely, "wages," "conditions," and "supervision."

"Wages" is intended to embrace all matters relating to the earnings and the opportunities for advancement. All employees who are hired and who fail to report are also classed under this heading on the assumption that they must of necessity be engaged in gainful occupation, the reason for their non-appearance obviously being that they have secured more remunerative employment elsewhere. When an employee expresses a desire to follow a different line of work, or states that he has another position, the fact is also recorded under "wages," as most moves of this nature may be considered, from the employee's standpoint, in the light of betterment, real or fancied.
are of three kinds: physical, internal, and external.

The physical conditions have to do with the safety, sanitation and comfort of the employee while engaged at his daily task, and all items which have a physical remedy should be included under this heading. To refer to the chart, we use the words "congestion" either of space, material or equipment; "illumination" or the lack of it; "ventilation," which is also intended to embrace changes in temperature and the presence of dust or fumes; "noise"; "severity," in which is incorporated the common objection to heavy work, too much standing, too much stooping, lifting or walking; and "danger." In other words, a physical condition as a cause for labor separation is one that can be eliminated or corrected by altering, adding to or removing such parts of the buildings, equipment or process as contribute to the obnoxious features. In periods of non-employment physical conditions must be bad indeed if they will cause a large percentage of separations under this heading.

Internal conditions may be defined as any existing cause for discontent that cannot be corrected by physical means. Monotony, variety, night work and racial antagonism are causes which may be classed under this subdivision. These are self-explanatory with the exception of racial antagonism, which is intended to cover situations in which an employee of one nationality is placed with another or a group of a different nationality. This condition in some cases could be charged to poor placement but, as it more often rests with the foreman of the department in question to make assignments within the department, it is grouped under this heading.

External conditions include: Inaccessibility of the plant or office of the industry, lack of housing within a reasonable traveling distance, domestic troubles, and climate. These frequently occur as causes for leaving and, in the case of women employees, "family leaving town" or "to be married" forms a large percentage.

The Place of Management

The third subdivision of the voluntary causes has been named "supervision," and it is intended to embrace all causes resulting from the acts of persons representing management. In the broadest sense the clerk at the inquiry desk and the interviewer at the employment office, as well as the guide who conducts the worker on his initial trip to the job, are representatives of management and their acts are chargeable to "supervision."

"Poor placement," the first heading under "supervision," is responsible for some degree of separations. It should be assigned as a cause for separation where little effort has been made to determine the fitness of the applicant for the work of the company, or to place him where he will be of the greatest value to his employer or to himself.

"Lack of ambition," "lack of skill," and "roving tendency" are also arbitrarily assigned to "supervision," because of their being a natural outcome of previous contact which the employee may have had with management.

These causes are at present laid at the employee's door, but in this analysis it is felt that those directing the various elements of the business are representatives of the company and the points of contact between management and employee and, therefore, are not one hundred per cent efficient if they do not impart a certain amount of company spirit to the workers, and seek to eliminate the bad traits in the same manner that impurities are expected to be eliminated from the raw product. Unfortunately, it is simpler to separate mechanical impurities from an element than to eliminate faults, instill ambition and inculcate steadiness in the average applicant for work.

By "faulty management" is meant the lack of a definite labor policy, the absence of well-defined lines of authority, the absence of a "family spirit," and the tendency to discard the worn out worker when his day of maximum usefulness is past. Under this same general heading must be classified any other shortcomings which are apparent by an elimination of the preceding classifications. In fact, in the use of the chart, causes should not be assigned to "supervision" until after it is made certain that they do not belong under "wages" or "conditions."

Strikes are not considered in this analysis because they are usually brought directly to the attention of the management with a direct statement as to the remedies needed to avert them. If any compilations are necessary, they should be made the subject of a separate report using the same general outline of reasons as given. There is, however, one other cause for strikes of which no mention is made and that is the sympathetic strike. All other reasons for strikes may be classed under the three major subdivisions listed under "voluntary" separations.

Report on Service Discontinued. Week Ending.... 192..	
Voluntary, Men	
Wages	
Conditions	
Supervision	
Total Voluntary	
Involuntary, Men	
Discharged	
Unforeseen	
Laid Off	
Total Involuntary	
Total Men	
Voluntary, Women	
Wages	
Conditions	
Supervision	
Total Voluntary	
Involuntary, Women	
Discharged	
Unforeseen	
Laid Off	
Total Involuntary	
Total Women	
Grand Total	
Number Hired	
Pay Roll Average, Men	
Pay Roll Average Women	
Turnover	

Fig. 3. This Form Is Used to Indicate the Occupations or Departments Most Affected by Classified Separations Permitting the Major Causes of Separations to be Discovered.

The chart, with the explanations as given, furnishes the guide for filling out the report on services discontinued, Fig. 3. This report is intended to indicate the departments or occupations that are most affected and, in the case of a high percentage of separations from any department or occupation, the same form would be made out for a like period, classifying the positions vacated, thus permitting the major causes for discontent to be brought to light.

For purpose of record two graphic charts, one for men and one for women workers, should be plotted; with three lines of different colors showing respectively the voluntary, involuntary and total separations. When peaks occur, if the number of employees involved is sufficient, separate charts may be drawn according to the subdivisions within which the peaks occur, thus facilitating the location of the causes and supporting the employment manager in any recommendations he may offer as to the remedies to be applied.

Reducing the Number of Separations

The remedies for involuntary separation are not numerous. Those under "discharged" of a permanent nature are conspicuous by their absence, a criticism which applies also to most of the items comprising the unforeseen causes, although free medical advice, where there is a company doctor, will quite frequently reduce some causes of separation due to sickness.

For the separations of a temporary nature caused by laying off employees, in some industries it is possible to extend the business season by careful planning, spreading out the year's work more uniformly; also filling vacant seasons, wherever possible, with work other than that of the usual line will enable the organization to be held together where it would otherwise be necessary to dispense with at least a part of the force.

It is with the voluntary separations that management has its chance to make the best showing. In the matter of wages a reduction of competition for labor can be largely brought about by the exchange of rates between neighboring firms, thereby eliminating unfair practices; it also has a tendency to discourage drifting. In small industrial centers the use of the cooperative employment agency has met with no small degree of success. Fair compensation for the work performed will help steady employment where other conditions are favorable, and wage understandings between employer and employees have a tendency to maintain the proper wage relations.

For non-appearance or failure to report on the part of the employee after being hired, the management would do well to install an interviewer in the employment office who will "sell" the employee in such a manner that he will stay "sold."

The lack of promotion is a grievous fault and should be worked out thoroughly by a system of job analysis, and the lines of promotion should, wherever possible, be made clear to the prospective worker as well as to those already members of the force.

Bettering the Physical Conditions

As to physical conditions, modern shops with sanitary equipment, safeguarded machinery, necessary aids to comfortable work, proper lighting and heating, adequate lockers, lunch and toilet facilities, and good housekeeping are helpful in developing contentment and plant morale. With the installation of these features, in many cases a campaign of education is necessary to prevent their abuse by some classes of workers, and care should be taken that the employee does not get the idea he is being patronized at the time these facilities are made available.

The monotonous work can be corrected by a plan of transfer of operatives and others who cannot stand work of a nature too confining, and in some instances a rotation of work may be followed to give variety for those who react unfavorably to a steady performance; although the mere fact of repetition should not constitute an objection to a job, regardless of the fact that it affects adversely a percentage of employees.

Night work, where necessary, should be made as desirable as possible either by a periodic change of hours, or by a slightly increased hourly rate in the case of steady night work.

Racial antagonism, while to a certain extent a fault of the employment office, is largely the attitude of the management reflected in the workers and, where the necessity for an intermingling of racial groups occurs, the creation of an *esprit de corps* will do much to promote loyalty and extend the "family spirit."

Of the external conditions, the lack of transportation, except in the case of small industrial centers and isolated plants, presents a real problem. While sometimes arrangements can be made with the carriers whereby special concessions may be obtained, it has occasionally been found advisable to institute a bus service as a supplement to the existing facilities, and, in extreme conditions, to encourage motor service in which groups of employees arrange for transportation by private cars owned by fellow employees.

Outside or domestic troubles, such as difficulties at home, legal entanglements, particularly with "loan sharks" and installment houses, and sickness, may be mitigated by free health clinics, health insurance (thus relieving anxiety as to loss of time and insecurity of position), free legal advice, and forms of contact such as community houses, play grounds and visiting nurses, all tending to make contented employees and to eliminate those who would otherwise exploit them.

Where the family leaves town or the woman employee leaves to be married, there is little or no remedy, except, in the latter case, that occasionally married women like to have the "pin money" which is obtainable by continuing at their old position. This matter is to be governed by the policy of the company, scarcity of labor, and local conditions.

Opportunities for Management

The conditions most difficult to correct are those that surround the causes grouped under the heading "supervision." In many instances intensive and extensive "selling" is necessary to bring about a readjustment of the existing factors. In some cases it will be necessary to educate the higher executives as well as those in minor capacities. But, by all means, the point of contact between management and employee should be kept clean and bright by an endeavor to impart to the foreman the meaning of "company spirit."

A definite labor policy is essential to friendly relations between employer and employee. The training of foremen is recognized as an important means to prepare men properly to represent the management and to use diplomacy in handling matters of discipline, to become leaders, not drivers.

Ambition can be instilled in the indifferent employee by a proper personal contact of the industrial-relations representative with the worker. It can be still further augmented by instilling pride in attainment and by creating a desire for improvement through a judicious use of such means as educational moving pictures, lectures, and training classes.

The war work brought out the fact that lack of skill is best combated by training classes or vestibule schools, and the wonderful results obtained are on record as monumental proof of the success of this method of overcoming deficiencies in manual dexterity. Educational classes giving supplementary training or schooling, either in civics or in subjects allied to the trade, tend to produce efficiency and supplement the skill of the worker, and create a reservoir from which to draw timber for the foremen of to-morrow.

Poor placement may be remedied by a careful analysis of the work in hand to determine the requirements of the task and, in some cases, by a test for applicants to discover their qualifications. These are acknowledged requisites of intelligent placement.

The roving tendency can be offset by social activities, athletics, company stock ownership by employees, bonuses for long-term service, and pensions for old employees.

(*Continued on Page* 58)

The Use of Wire Saws Speeds Up the Work of Slate Cutting in the Quarries of Pennsylvania

Resulting Economies More Than Offset the Cost of Minor Practical Difficulties

By F. A. WESTBROOK

VERY IMPORTANT economies have resulted since the introduction of wire-saw cutting in the slate quarries of Pennsylvania about two years ago. Although this practice is new in this country, it has been in use for a long time in Belgium and the first operations here were performed with Belgian equipment. The obvious advantages of this method led to its adaptation to the conditions existing in this locality. Evidently it is well worth while to know what is going on in foreign countries as, occasionally, it is possible to introduce real economies by adapting foreign methods and machinery to American conditions. This is not strange in view of the fact that many operations in Europe have been going on much longer than in this country and, consequently, there has been greater opportunity to improve them.

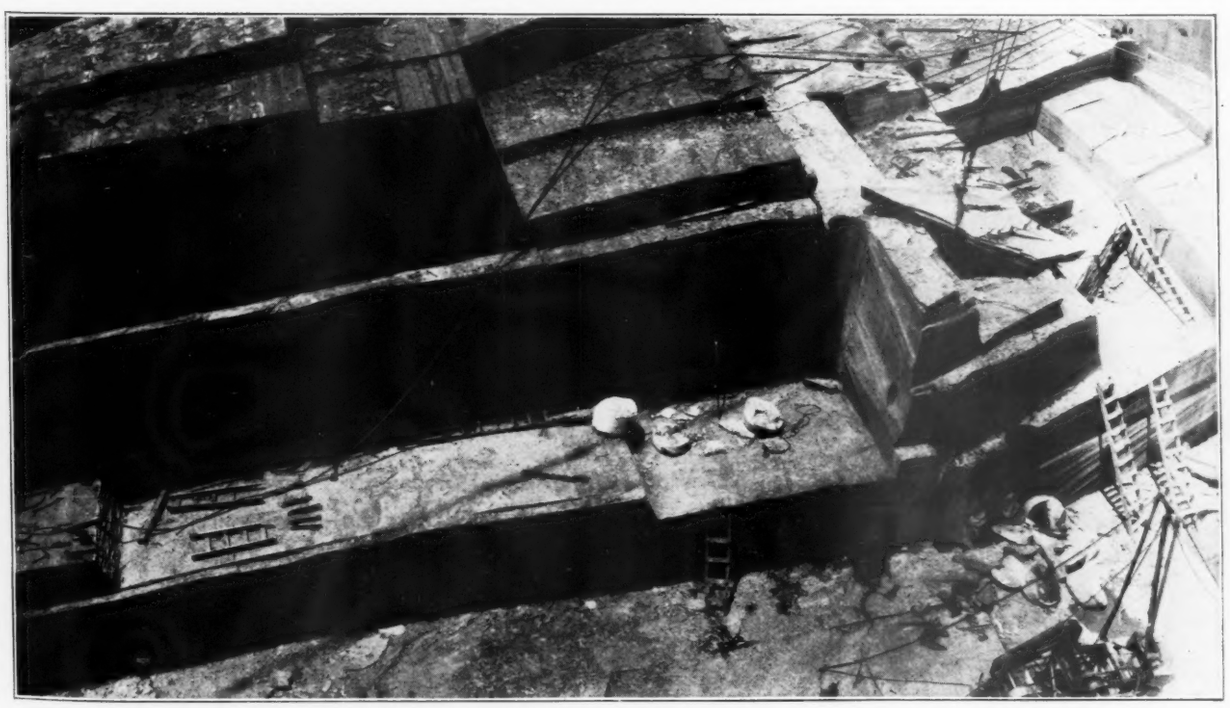
The wire saw is intended to displace the old-fashioned channeling machine. It operates more rapidly, is more simple as a machine, and requires less power and less labor. Its particular field of usefulness is where the laminations are more or less horizontal.

The best way to give an idea of what the wire saw actually is, how it works, and to what extent it is used is to give a brief outline of the latest report on the subject issued in March, 1929, by the Bureau of Mines and reprinted in PIT AND QUARRY, June 19, 1929. The photographs and description of the installations at the Phoenix quarry at Wind Gap and at the Keenan quarry at Penn Argyl show actual working conditions.

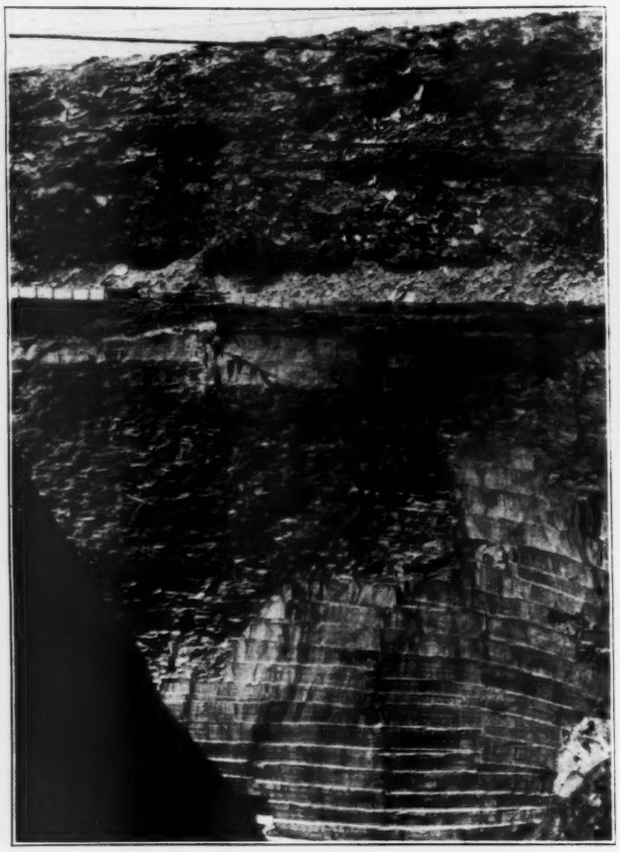
The Bureau of Mines report* states that, as quarrymen have gained experience in the use of the wire saw, they have reached an average cutting speed that is four to five times as fast as with a channeling machine. The saw itself consists of a three-strand hard-steel cable traveling at the rate of 15 ft. per sec., running as an endless belt and under a tension varying between 800 and 2,000 pounds. The driving mechanism consists of an electric motor and a speed-reduction unit more or less permanently located on the top of the quarry with the necessary sheaves to guide the wire into the quarry and to the desired locations.

In the quarry at the cut standards are placed in large bore holes provided with sheaves by means of which the wire is brought to bear on the rock.

*Report of Investigations, Serial No. 2918, U. S. Bureau of Mines, by Oliver Bowles.



View of the Phoenix Slate Quarry, Showing Part of Core Removed from Standard Hole.



Slate Formation in the Keenan Quarry.

The sheaves are moved up and down by means of a worm, so that the pressure may be maintained as the cut is deepened. The length of the cut can be almost anything, but in practice it is usually from 60 to 100 feet. The holes for the standards are made 36 in. in diameter by a newly developed type of core drill. Eighteen companies now use this equipment in the Pennsylvania district. Sand is used as the abrasive for the saw and steel shot for the core drill.

The making of the core holes and the removal of the core has gone through a process of development based on experience. The time required to sink a 10-ft. core has been reduced from three days to one under good conditions. To remove the core the latest method is to drill a jackhammer hole to the full depth of the core before drilling is started. After about 30 in. has been drilled, the drill is removed and a wedge driven into the cut. This splits the core along the natural cleavage of the slate and at the same time shifts the loosened block a little to one side. When a split key is then driven into the jackhammer hole in the core block, it strikes solid rock at the bottom, because the central drill hole is out of line with that in the lower part of the core still to be drilled, so that it may be spread with a wedge and lifted out by the hoist.

The principal difficulty of a practical nature occurs when the wire saw is pinched so that it cannot be moved. This happens sometimes when the rock is under compressive stress and when the first sink cut on a new level is made. Usually the expansion of the rock which causes this takes place so slowly that, if the saw is kept running constantly, it will not be caught. This is one reason for operating the saw night and day. Sometimes slipping of the rock may be prevented by drilling holes and driving plug and feather wedges into them. As soon as the first line of blocks on the new level has been removed, the pressure is relieved and there is then never any pinching.

Flanged-wheel Tractor Used to Haul Slate Blocks at the Phoenix Quarry.

Cutting Standards Set Up in a Wide Channel of the Phoenix Quarry.

Tension Standards at the Keenan Quarry.

The Phoenix Slate Company

The Phoenix Slate Company at Wind Gap, Pennsylvania, has two wire saws and one core-drill in operation. A new saw drive which has just been erected is shown in one of the illustrations. It is driven by a General Electric 10-hp. induction motor through a Philadelphia Gear Works speed reducer and is provided with a Federal safety disconnect switch, a Trumbull reversing switch, and General Electric push-button control.

The three-strand steel wire, which has a hardness between that of plough steel and spring steel, is obtained both from the American Steel & Wire Company and John A. Roebling's Sons Company. The wire is run at the rate of 15 ft. per sec. and lasts, as a general thing, for three days. It has been found, according to the experience of the superintendent, R. B. Lewis, that, if the wire is run too fast, it carries the sand away. The other wire saw is driven by an Allis-Chalmers 10-hp. induction motor through a Foote speed reducer.

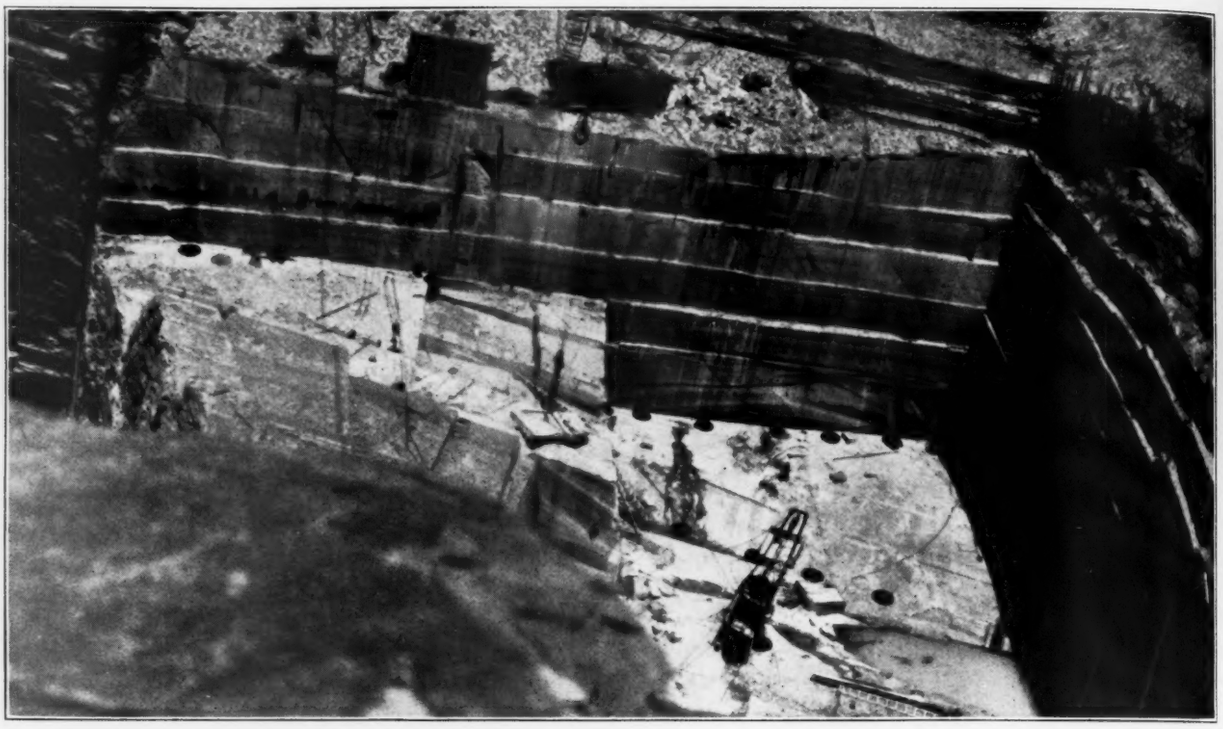
Handling Blocks of Slate in the Phoenix Quarry.

The Core-drilling Machine as Used by the Phoenix Company.

In this quarry cuts are made from 80 to 120 ft. long. The record for speed is a cut 120 ft. long by 36 ft. 6 in. deep in 48 hr. running time. In this case conditions were good. It often happens that the saw is run all night and, under such circumstances, two men are kept on the job, one to tend the motor and one at the cut.

When a block has been cut, it is wedged loose without the use of explosives. The core-hole blocks are usually broken loose by a small charge of black powder. The core-drilling machine was made by the Ingersoll-Rand Company and the standards and tension cars by the Stroudsburg Engine Works.

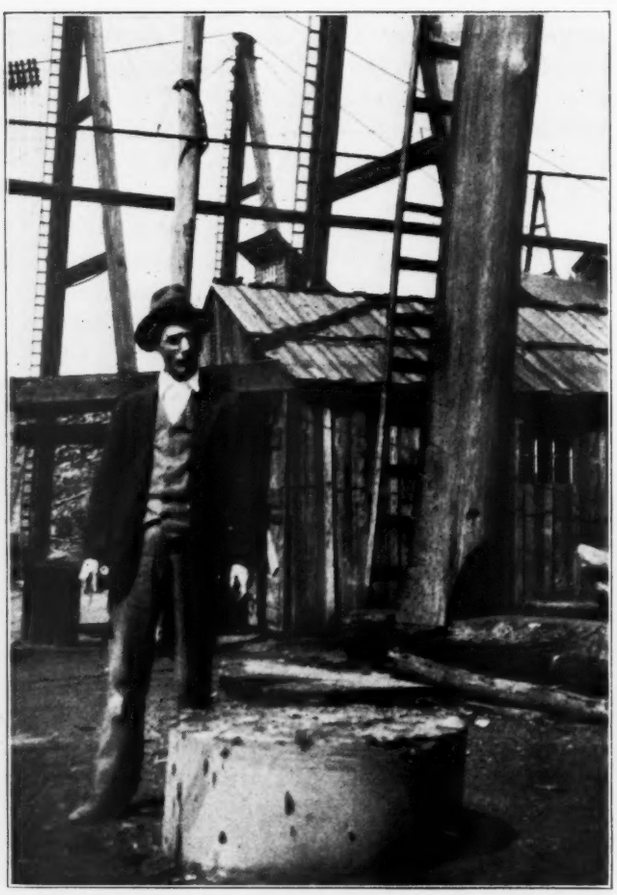
Among other equipment at this quarry are six Flory hoists with double drums driven by two-cylinder steam engines. A Fordson tractor is used at the top of the quarry as a dinky to move cars carrying blocks of slate in and out of the mill and elsewhere about the plant. It has been equipped with flanged wheels to enable it to travel on tracks and has a cab for the protection of the operator. Steam for the various engines is furnished from a



Standard Holes Ready for Cutting at the Phoenix Quarry.

central boiler plant consisting of three 150-hp. International boilers equipped with Huber hand stokers which, since their installation, have saved something like a carload of coal per month. Compressed air is furnished by a Type 10 Ingersoll-Rand compressor which acts also as a feed-water heater. The other machines in the mill are mostly Flory machines except that Double O Disston saws are used.

The principal products of this company are billiard-table tops, blackboards, and shingles. The cores from the holes made for the wire saw standards are used in particular for the shingles.

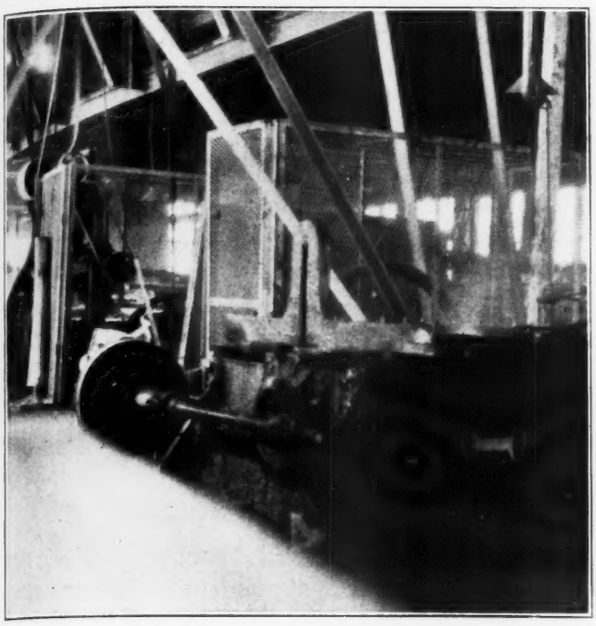


Edward H. Tait, Superintendent, Keenan Company.

Keenan Structural Slate Company

The Keenan Structural Slate Company has a large operation at Penn Argyl, Pennsylvania, employing 150 men, and with a pit 600 ft. deep covering 12½ acres. The products include roofing, blackboards, sinks, tubs, toilets, trays, electrical slate and structural slate.

The Keenan Slate Plant at Penn Argyl, Pennsylvania.



Circular Saw in the Finishing Mill of the Keenan Company.

There are two wire saws and one 36-in. core drill. The saws are driven by 10-hp. Allis-Chalmers induction motors with Foote speed reducers. The tension carriages and standards were made by the Penn Argyl Manufacturing Company and the Stroudsburg Engine Works. The superintendent, Edward H. Tait, is extremely well satisfied with this method of cutting.

The quarry is spanned by seven cableways, each of which is provided with a Flory hoist driven by a 75-hp. steam engine. For the longest span of 1,800 ft. 2½-in. wire rope is used, with ¾-in. rope for hoisting, and ⅜-in. jack rope. The rope is all made by the Hazard Wire Rope Company and the Steel Wire Products Company.

Two Ingersoll-Rand compressors, steam-driven, supply compressed air for the various operations about the plant, and there is a central boiler plant consisting of four Coatsville boilers. Coal for these boilers is dumped from freight cars into a hopper adjacent to the plant. It is passed through a Link-Belt roll crusher to break up the large pieces and is then placed in bins by a Link-Belt elevator.

Wire-saw Driving Equipment at the Phoenix Plant.

There are two finishing mills with practically similar machinery. One has four circular saws, three rubbing beds, three Flory planers, a Pollard carborundum machine for making mouldings and similar articles, and a 5-ton Shepard traveling crane.

Aerial Tramways Help Basalt Plant

(*Continued from Page* 45)

veyor has a gravity take-up; all others have screw take-ups at the tail pulleys. All head and tail pulleys, take-ups, troughing and return rolls, and screens were furnished by the Bodinson Manufacturing Company. Practically all the belting was made by the New York Belting & Packing Company. The wire rope is of Hazard make.

All gates feeding the conveyors are of the hinged-chute type, lever-graduated control, so that sizes can be accurately proportioned.

The office and each plant unit are interconnected by telephones. The only alteration contemplated is the provision of side-delivery gates in the 2,000-yd. bunker so that trucks can be loaded with rinsed rock. All motors are 3-phase, 60-cycle, 440-volt. Transformers at each unit step the current down from 2,200 to 440 volts. At the quarry all motors have controllers. At the storage and shipping units, where possible, the controllers are in banks at convenient stations and labeled.

Quite a market is being developed for the oil mix which forms an excellent pavement when spread and rolled. The company also does a large business in oil for fuel, oil burners, and road treatment.

The officers of the company are: A. G. Streblow, president and general manager; H. Morris, secretary; A. W. Stremmel and Dr. Robert Crees, directors. The office manager is Ed. Brovelli; the quarry superintendent is Louis Cassayre; the superintendent of the secondary-grinding, sizing and storage section is Richard Vitala; while the superintendent of the shipping and oil-mix section is Harold Benton.

National Sand & Gravel Association Changes Convention Dates

V. P. Ahearn, executive secretary of The National Sand & Gravel Association, announces that a decision has been reached to change the dates for the Memphis convention from January 27 to 29, as previously announced, to January 28 to 30, 1930.

The Resistance of Slag and Slag-Concrete Mixtures to Destructive Agencies of Various Kinds

Samples Show Uniformly High Power to Resist Corrosion and Weathering Tests

THE National Slag Association, of Cleveland, Ohio, has published Symposium No. 17 of a series describing the characteristics and uses of blast-furnace slag. This symposium, entitled "Resistance of Slag and Slag Concrete to Certain Destructive Agencies," quotes statements made by authorities, articles from engineering magazines and technical papers on this subject.

Tests of Slag

The U. S. Bureau of Public Roads in 1922 conducted an investigation of slags which included sodium-phosphate tests for soundness of coarse aggregate. This consisted of 5 cycles of sodium-sulphate immersion for 20 hr., followed by 4 hr. in the drying oven. Raymond Harsch, junior assistant testing engineer, U. S. Bureau of Roads, reports the results of these tests in "Blast Furnace Slag as Concrete Aggregate" in the 1923 *Proceedings* of the American Society for Testing Materials. He states that "The test showed all the samples to be durable, free from checking, cracks or signs of disintegration." Thirty-two slags figured in this series of tests.

The U. S. Bureau of Standards recently made tests of the durability of various concrete aggregates, including sodium-sulphate, sodium-chloride, boiling-and-drying, and freezing-and-thawing tests. Thirty-six samples of coarse aggregates were separately tested, including 3 granites, 4 trap rocks, 4 sandstones, 7 limestones, 6 slags and 12 gravels. *Technical News Bulletin* No. 123 published in 1927 gives the results of 24 freezing and thawing cycles on 28 varieties of aggregates and 40 cycles on all varieties in the other three treatments. Results showed that limestone disintegrated most with gravel next. Granites were not affected and only occasional pieces of trap, sandstone and slags showed signs of breaking up under these tests.

Tests of Slag-Lime Bricks

Henry F. Gilg, member, Engineers' Society of Western Pennsylvania, in the *Proceedings* of that society in 1915 states that "a brick slag exposed to a temperature of 1,200 deg. for one hour was submerged in water and remained entirely intact. Another was exposed to 1,470 deg. and when submerged in water showed only a few cracks."

Tests of Slag Concrete

Slag as a coarse aggregate in concrete has the property of resisting corrosion of various kinds. Curtis C. Myers, professor of industrial engineering, University of Cincinnati, in an article, "Slag Makes Light and Strong Concrete," published in *Engineering News Record*, May 16, 1918, says that "slag concrete withstands the action of acids better than stone concrete."

Resistance to Corrosion

Slag Concrete.—Wilbur J. Watson, in "Steel Still Bright in Old Concrete," published in *Engineering News Record*, February, 1924, notes the resistance to corrosion of the slag concrete in the Higgins Building in Cleveland which was razed to make room for the new Union Station. He says, "The lowest floor of the building, it appears, was subject to a great deal of moisture owing to leakages through the wall, and also to the use of part of the floor for pickling, which must have resulted in considerable acid in the atmosphere. Yet there was no indication of a damaging effect on either steel or concrete."

Seawater Concrete.—One of the foremost problems facing concrete engineers to-day is that of providing a concrete which will resist the ravages of seawater. This common failure is attributed to the magnesium and ammonium salts contained in the seawater. Dr. Guttman, research director, Eisen Portland Cement Association, Düsseldorf, Germany, in "Use of Slag in the Building Industry" published in 1919, makes the following comment on some tests made in Germany: "It is seen that the slag concrete quietly goes on hardening in seawater. The tests of concretes made out of iron portland cement developed in the average a little higher strength than those of portland cement." In the tests comparing Rhine gravel concrete and slag concrete he finds that "Rhine gravel concrete develops less strength in seawater than concrete of broken slag. The cleaning from rust of the rusty iron reinforcements proceeded further in the slag-concrete samples than in the gravel concrete samples."

Concrete Chimneys.—A very severe test of resistance to corrosion is found in structures such as factory chimneys and blast-furnace stacks. The *Iron and Coal Trades Review*, issue of January 24, 1908, says that in England chimneys from 100 to 150 ft. in height have been built of slag-concrete bricks at the various works of Baldwins, Limited. These chimneys are exposed to high-temperature

gases, and the corrosive effect must be considerable, yet their record in service is excellent.

Slag-Concrete Sewers.—The City of Atlanta, Georgia, in 1923 used 22,000 tons of slag in the construction of 8,400 linear ft. of concrete sewers. According to *Manufacturers' Record,* June 14, 1923, these sewers are from 5½ ft. to 12 ft. in diameter, semicircular in shape, and were built in place. The effect of sewage on this concrete was carefully watched, but no disintegration or damage has been apparent.

Chemical Filter.—E. C. Brown, chief civil engineer, Carnegie Steel Company, in his paper, "Utilization of Iron and Steel Works' Slags," published in the 1915 *Proceedings,* Engineers' Society of Western Pennsylvania, says: "Blast-furnace slag has already found its way into quite an extensive field of industrial usefulness, principally, of course, as construction material. A complete list of these uses would be quite extensive, and I will enumerate a number of the more important ones only: For granulated slag—as filter material in certain chemical recovery processes, etc."

Slag Admixture in Concrete.—Dalton Miller, drainage engineer, U. S. Department of Agriculture, in "Laboratory Investigations of the Influence of Curing Conditions and Various Admixtures," published in the 1924 *Proceedings* of the American Society for Testing Materials concludes that "the addition to concrete of powdered slag up to 40 per cent of the weight of the cement apparently had little or no effect on the strength or absorption of the concrete, although resistance to sulphate waters was increased closely proportional to the quantity of slag used."

Slag-Lime Bricks and Stones.—Dr. Guttman found the resistance of slag stones to acid and alkalies to be very great. He also says, "Other evidence coming from the experience of a cellulose factory demonstrates that slag stones with their surfaces exposed for ten years to sulphuric-acid liquid (12 to 16 per cent free sulphuric acid) were better preserved than clay bricks. The capability of standing vapors of sulphuric acid is also attested by a certificate of the Office for Testing Materials in Lichterfelde." He also made stones with a concrete mixture of slag and cement, and found that "they had an extraordinary power of resistance against the salts in seawater and against shaft lyes."

Weathering

Slag Concrete.—James O. Handy, in the 1915 *Proceedings* of the Engineers' Society of Western Pennsylvania says that "when granulated slag is used in concrete, the air is almost completely excluded, and if slag is as permanent as it seems to be in air, it certainly will last indefinitely in concrete."

Sanford E. Thompson, consulting engineer, in "Slag as Concrete Aggregate" in the 1917 *Proceedings,* American Concrete Institute states that "the weathering qualities of slag concrete are indicated as satisfactory by examination of structures which have been built for a number of years."

Slag.—Tests on the weathering of slag samples were made by the Imperial Department of Testing Materials at Berlin, Germany, from 1911 to 1916. Professor H. Burchartz, staff associate, and Professor O. Bauer, staff associate, Department of Metallography, in "Experiments with Blast-Furnace Slag," *Stahl und Eisen,* 1917, state that "of the 21 slag samples, which represented 5 different sorts, 9 gave indications of cracking or crumbling in some individual pieces in the course of the first year of storage in the open. After 2 years of storage an increase in crumbling could be recognized in only 6 samples in individual pieces, and after 4 years in only 3 slag samples. The rest of the slags, as far as could be judged from outward appearance, remained unchanged during the entire period of observation." The authors also state that some of these slags, due to their composition and method of cooling, were expected to crumble and would not have been used commercially.

Slag Cements.—Dr. Guttman says of a slag plaster made in Germany that "we have testimonials that declare Terra Budera (plaster) to be as good as any of the improved plasters in standing the weather and keeping its color. Praise is given for its continually increasing hardness and tenacity, which is attributed to the slag cement which it contains."

Stability

The stability of a material is so closely related to its resistance to weathering that it is not always possible to determine whether crumbling is due to inherent instability of the material or to the effect of the elements.

Dr. J. E. Stead, metallurgical chemist, in "Blast-Furnace Slag in Concrete and Reinforced Concrete" published in *Engineering World,* February and March, 1919, says, "Slags with high content of alumina and magnesia and low proportion of lime have never been known to disintegrate on exposure to air or rain, and are for that reason suitable at all times, whether weathered or not, for concrete making. Slag balls which have been exposed to the weather for fifty years show no sign of disintegration."

Aging of Slag.—L. G. Carmick, chemist, U. S. Bureau of Roads, in "Study of Composition of Blast-Furnace Slags," in the 1921 *Proceedings* of the American Society for Testing Materials, said that in his tests the slags which disintegrated did so within a week and concluded that slags which were delivered as a commercial product in solid form would remain in that condition.

W. D. Brewer, of the Duquesne Slag Products Company, in "Blast-Furnace Slag," a paper presented at the meeting of the Testing Engineers and Chemists of State Highway Departments, February 25, 1920, stated that "in the slag commercially obtainable and used, it does not occur. If any part of the air-cooled blast-furnace slag in the banks and pits from which it is obtained does break down, the action takes place promptly on exposure to air and would be easily discoverable on inspection and handling."

Density of Concrete

Professor H. Burchartz in "Experiments with Blast Furnace Slag," published in *Stahl und Eisen*, 1917, finds that "The concrete mixture used for the tests showed itself sufficiently dense to prevent the penetration of water and air into the concrete and to guarantee a rust-proof covering for the iron inlays in the concrete. The weight per unit of volume of the concrete compression samples increased very little with advancing age, a proof that the samples are quite dense and have taken up in the course of time only a little water."

Durability

Wilbur J. Watson, consulting engineer, in "Steel Still Bright in Old Slag Concrete," published in *Engineering News Record* February, 1924, refers to the Eldridge-Higgins Building in Cleveland, previously mentioned, as follows: "The concrete was very tough and drilling was difficult. The slag proved to be much more difficult to drill than gravel concrete. The concrete itself is in excellent condition and the steel apparently was well placed. Careful examination of the work failed to show any corrosion whatever at any point in the steel."

C. S. Hill, associate editor, *Engineering News Record*, in an article, "Slag-Concrete Roads, Their Construction and Wear," published in that magazine September 14, 1922, makes the following statements: "Inspection of some 20 slag-concrete roads built from 1913 to 1921 and aggregating approximately 100 miles has led to the following conclusion: No disintegration of slag-concrete roads due to the slag content of the concrete was observed. Nowhere was evidence presented of any unsoundness of concrete because of any chemical content of the slag aggregate. Slag-concrete roads exhibit cracking, corner breaks, shattering, and practically every other sort of failure characteristic of paved roads, but to no greater degree than other concrete pavements of corresponding age and construction practice. Practically all slag-concrete roads exhibit surface imperfections due to general pitting. It is a curious circumstance of this condition that the small pits do not often enlarge by breaking down at the edges. They are a defacement rather than a structural damage. Concrete roads with slag as the aggregate are in the main in as good shape as those using natural aggregate."

Dr. C. E. Bardsley, professor of civil engineering at the University of Missouri, in an article, "Historic Slag Road, 95 Years Old, in Missouri," published in the March, 1926, issue of *Highway Magazine*, describes a road which was built in 1830. He says that "during the early operation of the furnace (1825-30) a slag road was constructed which is to-day in good shape and, so far as I can learn, no repairs have ever been made on the portions of the road where slag was used. This road has always been in constant use as it affords the only outlet for a considerable scope of country. Consequently all hauling has to be done over it, and now there is scarcely a day passes in the spring, summer or fall without 100 to 300 motors visiting the springs. The road is in excellent condition and for years has been one of the best roads in Phelps County."

A. Dryland, county engineer and surveyor, Middlesex, England, in "Notes on English Bituminous Road Practice," *Engineering News Record*, May 26, 1921, says "The most approved form of tarmacadam construction used in England to-day is undoubtedly that in which slag is used as aggregate. Coatings so constructed have had to date a life of 9½ years with trifling repairs."

Conclusions

The symposium concludes by stating that probably the best test of slag and slag concrete is furnished by their use in sewage-disposal plants. There the slag is placed in filter beds which receive regular applications of sewage liquid, the destructive nature of which is often increased by the presence in the sewage of industrial wastes. Slag concrete is widely used in sewage-plant construction for the beds in which the filter medium is placed and for the primary and secondary settling tanks. In this way both the slag and the slag-concrete are subjected to the same destructive agencies above mentioned as well as to the effects of sun, rain and frost.

Why Do Men Quit?

(*Continued from Page* 50)

Employee representation in management, while not regarded as a panacea, will be largely instrumental in removing many causes of dissatisfaction and will permit a frank discussion of real or imagined wrongs and mistreatment. Employee representation, however, must not be regarded in the light of an experiment, or fair-weather proposition, to be discarded with the appearance of the first storm. It must emanate from a sincere desire on the part of the management to ameliorate the conditions of the employee.

United States Gypsum Production Facilities Are Greatly Increased by New Indiana Plant

Second of Four Great Projects Near Large Centers Covers Sixteen Acres

THE East Chicago plant of the United States Gypsum Company—the second of the four new metropolitan plants this company is building—began operations July 15, 1929. The plant is situated on the Indiana Harbor Canal in East Chicago, Indiana, and, with a sister plant now nearing completion at Detroit, will revolutionize service on gypsum building materials in the north-central states. The plant is of similar design to the company's new Boston plant, described in the April 10 issue of PIT AND QUARRY, but is considerably larger, consisting of 21 buildings and covering an area of 16 acres.

Structural-steel-and-concrete construction was used throughout. The outer walls of the buildings are of brick, the floors of reinforced concrete designed to carry varying loads from 50 lb. to 600 lb. per sq. ft., and the roofs are of the United States Gypsum Company's 3-in. by 12-in. by 30-in. Pyrobar roof tile, laid on special bulb tees and protected by a 20-year tar-gravel roof covering. All foundations are of concrete of the spread-footing type with the exception of the rock-storage bin which is supported on wood piles. The United States Gypsum Company's Pyrobar partition tiles were used for all partition work, and all buildings are equipped with steel sash and steel doors.

Excavation was begun on August 22, 1928, and the project was completed in about eleven months. Considerable delay occurred in the fall due to the necessity of making elaborate test borings to ascertain foundation conditions. The heaviest part of the construction work was done last winter with temperatures around zero, but the Turner Construction Company of Chicago, which had the contract for erecting the buildings and installing the machinery under the direction of the United States Gypsum Company's engineering department, installed preheating equipment which permitted the pouring of concrete to proceed uninterruptedly during the winter months.

The major units are five in number and consist of the calcining mill, which is 280 ft. long by 80 ft. wide and four to seven stories in height; the warehouse, 260 ft. long by 80 ft. wide and four stories in height; the Sheetrock plant, 740 ft. long by 60 ft. wide and one and two stories in height; the block plant, 340 ft. long by 100 ft. wide and two

©Chicago Aerial Survey Company.

Aerial View, East Chicago Plant, United States Gypsum Company.

stories in height; and the rock-storage bin, 460 ft. long by 100 ft. wide and 112 ft. in height.

The minor structures are the office building, gate house, locker room and garage, laboratory, oil storage, trainshed, dehumidifier house, cement-rock bin, substation, secondary switch house, pump house, deep-well house, process-well house, unloading crane, main-line switch house, and ash-handling house.

Strong Foundations Needed

On account of the great size of the machinery, some of which had to be placed on the foundations before the steel work could be erected, it was necessary to construct very heavy foundations, especially under the great rock-storage bin, which is designed to hold 125,000 tons of gypsum rock and is one of the outstanding features of the project. This bin is supported on 4,028 southern yellow-pine piles, varying in length from 60 to 80 feet. Reinforced-concrete retaining walls 40 ft. high, of the cantilever type, form the base of this structure, on the top of which, rising to a height of 70 ft., is a super-structure of structural steel with copper-bearing corrugated-steel roofing and siding.

A few figures will help the reader to realize the size of the project. In the buildings there were used approximately 4,100 tons of structural steel, 1,200 tons of reinforcing steel, 35,000 barrels of cement, 2,500,000 bricks, and 140,000 sq. ft. of Pyrobar roof tile. The total floor area is 309,400 square feet.

On the Indiana Harbor Canal is constructed a dock of typical all-wood sections, and equipped to unload the ships which will bring the raw gypsum rock from the company's quarries at Alabaster, Michigan, on Lake Huron. The quarry operations at Alabaster are of special interest. Owing to the shallow water and to the gypsum lake bottom, it was found impracticable to construct a dock there of the required length. The problem was solved by constructing a crib 7,000 ft. out in the lake. On the crib has been constructed a large enclosed rock bin, which is filled at the rate of 300 tons an hour by an aerial tramway, supported on eight steel towers 60 to 80 ft. in height and resting on cribs. A belt conveyor carries the rock to the ships anchored alongside the storage bin.

Boats arriving at the dock at East Chicago are unloaded in 24 hr. by means of a large unloading tower, the rock being carried over the wall and into the rock-storage bin by a belt conveyor.

Handling and Grinding

A traveling crane, with a 3-cu.-yd. clamshell bucket, reclaims the rock from the rock-storage bin and, by means of a hopper and feeder attached to the crane, discharges it on to a reclaiming belt conveyor, by which it is taken directly to the calcining mill. Here the rock is passed through a crusher and screens, the fines being spouted directly to the dryer bin and the oversize rock conveyed to the cement-rock bin.

From the dryer bin the rock is fed by reciprocating feeders and a belt conveyor to the dryer. The rock is then elevated and, after passing through a second crusher and over screens, the coarse rock is conveyed to the rock bin and the "fines" to the separator feed bins.

From the latter the rock is fed into mechanical separators, the "fines" being conveyed directly to the land-plaster bins. The coarse rock is fed into the mill-feed bins, thence into the pulverizer, and, after being pulverized, is conveyed to the land-plaster bins. By means of a screw conveyor the gypsum is then fed to the calcining kettles, which are of the company's own standard design. Coal is used for fuel.

The stucco from the kettles is discharged into steel hot pits, from which it is drawn by means of a conveyor into a bucket elevator, which discharges it into the kettle stucco bins. After passing over a scalper screen, it is carried by screw conveyors to the 1,000-ton stucco-storage bins in the warehouse or to the block and board plants.

The equipment of the warehouse consists of a battery of mixers and packers, with electric trucks for transporting the material.

Each piece of machinery in the plant is driven by individual motor. Power is supplied by the Northern Indiana Public Service Company through the United States Gypsum Company's transformer stations.

A feature of the plant—one most unusual in a plaster mill—is a highly efficient dust-collecting-and-washing system. The vents from the dust collectors, elevators and other pieces of equipment discharge into a washing system where all dust is removed. This system comprises a number of tunnels, into which a large quantity of water is discharged through spray nozzles, causing a dense fog and collecting all dust too fine to be taken up by the dust collectors.

Improved Board Machine

The board machine, on which are produced Sheetrock wallboard, Rocklath, Standard X Gypsum lath, and Gyplap sheathing, is of the company's own design, capable of molding these fiber-surfaced gypsum sheets as uniformly as boards of dressed lumber. The process consists of distributing the gypsum and water mixture between two sheets of fiber. As the product passes along the bed of the machine, it is given form by a series of rollers, and the reinforced edges, a feature on which the company holds patents, are automatically folded and shaped.

Among the numerous refinements in this board machine is an ingenious device which, by chamfering the edges of the fiber covering, insures edges of exactly the same thickness as the rest of the board. Another improvement is a device which cuts the ends of the boards much more cleanly than formerly. Perhaps the most important improvement, however, is in the quality of the fibrous surfacing of the boards. This fiber, which is made in four company-owned plants, is of unusual strength and toughness, and has a decorating surface so hard and close-grained that it can be written on with pen and ink. Taking advantage of the popular demand for color, the company has given this new surfacing a good-looking ivory tint.

The block machine also is automatic and capable of producing partition tile, column and beam covering, and steel-reinforced roof-deck tile with remarkable speed and precision.

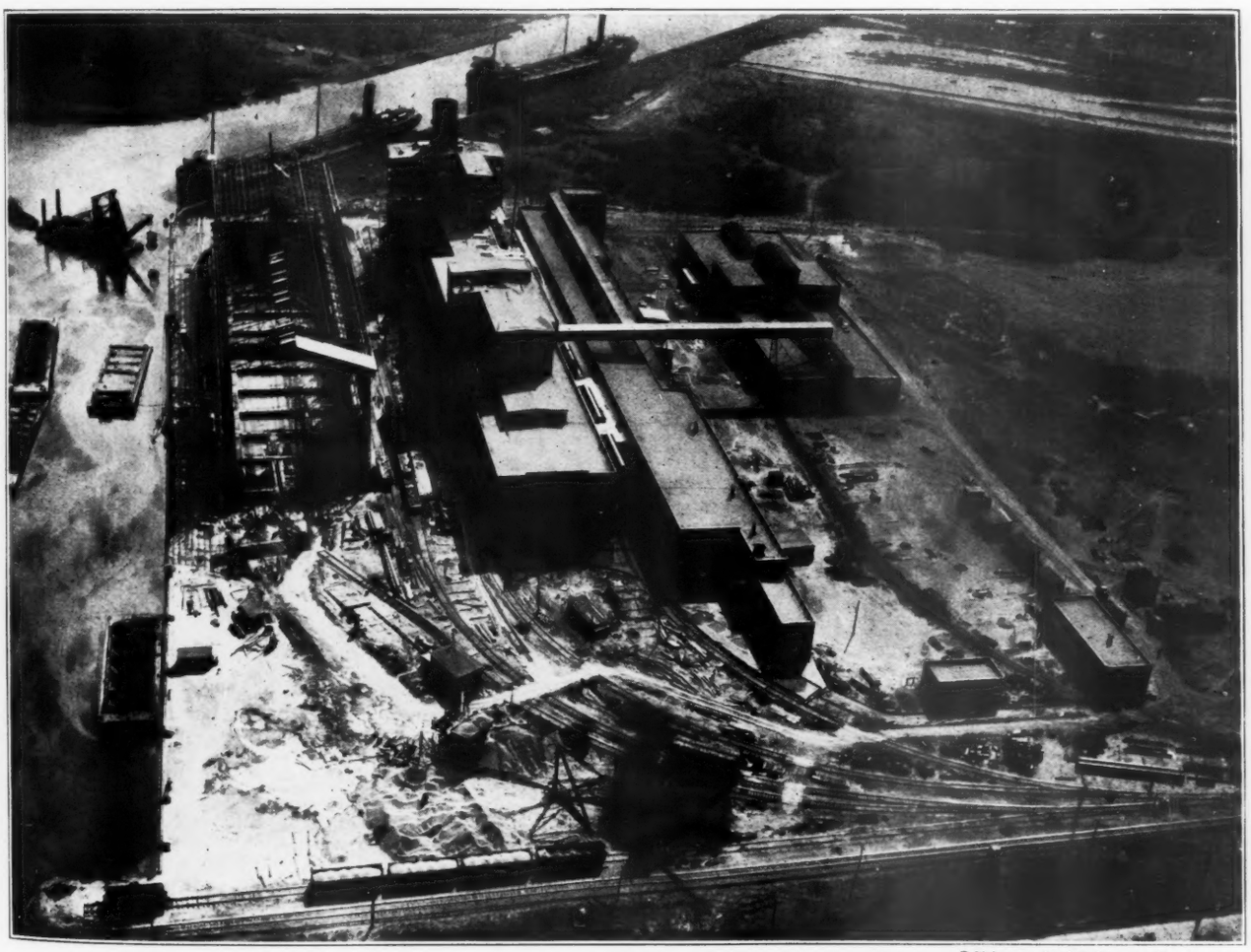
In addition to the board and block products and the company's Red Top wall plasters and finishes, the Chicago plant will produce numerous products for industrial use, such as terra-cotta plaster, plate-glass stucco, and gypsum retarder for portland-cement plants.

The plant was designed by and constructed under the direction of J. H. Nold, chief engineer of the United States Gypsum Company. He was assisted by E. B. Johnson, supervising engineer; S. L. Griffith, assistant to chief engineer; J. M. McGee, in charge of design; A. A. Frosdick, works manager; and R. W. Lee, resident engineer.

About the plant on every hand are evidences of the efforts which the company has made to assure material dealers of efficient and speedy service. Special provision has been made for shipping the company's products in mixed cars by laying more than 2½ miles of side track.

Highway Research Board Annual Meeting

The Ninth Annual Meeting of the Highway Research Board will be held on December 12 and 13, 1929, in Washington, District of Columbia, at the building of the National Academy of Sciences and National Research Council. An important feature of the meeting will be the presentation of of highway research now in preparation by the progress reports upon the comprehensive program board.



©Chicago Aerial Survey Company.

View Showing Splendid Docks and Railway Trackage, East Chicago Plant, United States Gypsum Company.

Efficient Air Cleaners Are Necessary Accessories to Engines and Air Compressors

They Fully Justify Their Installation Cost Even When Bought for Use with Old Machines

By WM. K. GREGORY

ARE air filters really necessary for the proper protection of air compressors and internal combustion engines? This is a question which every plant operator will have to answer for himself, after making an analysis of his own conditions, but there seems little question that air filters should be installed on every new engine and compressor placed in service.

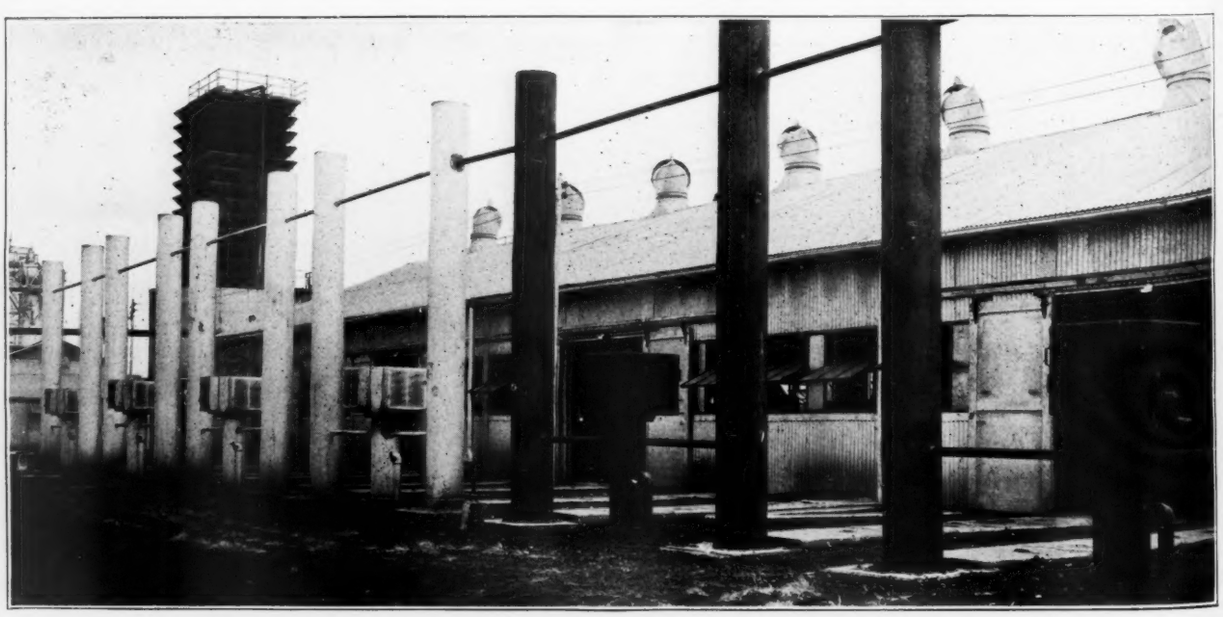
Good Practice, the criterion of the engineer, dictates that this be done, and good practice in this particular instance has been established largely by the manufacturers of engines and compressors themselves. Over 90 per cent of the engine and compressor manufacturers favor the installation of air filters on all their machines, and insist on them where the dust conditions are particularly severe.

In every industrial district the air is far from clean, and contains a large amount of dust much of which is of an abrasive nature. Foundries, railroad yards, rock quarries, cement plants, sand pits, power plants and unsodded lots are the principal sources of this dust, and plants in close proximity to these sources will have the greatest need for filter protection.

The ideal time to install an air filter is when the engine or compressor is new. Most engine and compressor manufacturers sell air filters and you can order them at the same time your other equipment is ordered. The cost is usually less than 1 per cent of the engine or compressor cost, and they therefore serve as cheap insurance against premature wear and excessive maintenance costs.

For old equipment, which has been in service a number of years, there might be some question about air filters proving a profitable investment. More wear will usually occur during the first year of operation than during any two subsequent years. The reason for this is that the clearances between pistons and cylinders, and in bearings, is quite small when the equipment is new, and the most minute grit particles in the lubricating film, as well as the larger particles, have their effect in producing wear. In fully 50 per cent of the cases, however, air filters will prove a profitable investment when installed on old machines. In addition to reducing wear on the moving parts, air filters will keep the valves clean and thus eliminate considerable maintenance expense.

In this connection it might be interesting to review one or two specific cases. The L. & N. Railroad had a large compressor (4,000 cu. ft. per min.



Installation of Six Cell-type Filters Which Clean the Air for Six Large Gas Engines.

Cell-type Filter Installed on Air Intake of Compressor.

capacity) mounted in its shops at South Louisville. The dust conditions were quite severe, due to their close proximity to railroad yards. Their regular maintenance schedule called for shutting down this compressor every two weeks and cleaning all the valves, which were always caked with dirt in this length of time. Air filters were placed on the air intake in 1924, and the present valve cleaning schedule is once every six months.

The Standard Sanitary Manufacturing Company, whose air consumption totals approximately 24,000 cu. ft. per min., had a serious problem in keeping their compressors operating efficiently. The power plant is not far removed from their foundries and the air always contains considerable foundry sand. Frequent shut-downs were necessary in order to clean valves or replace broken parts, and maintenance was both expensive and unpleasant.

Probably the first large installation of air filters on compressors was made at this plant in 1923. A total of 40 unit type air filters of the oil impingement type were used to protect all their compressors, and they are still in operation. There is nothing to the maintenance problem now, and a broken valve is a rare occurrence.

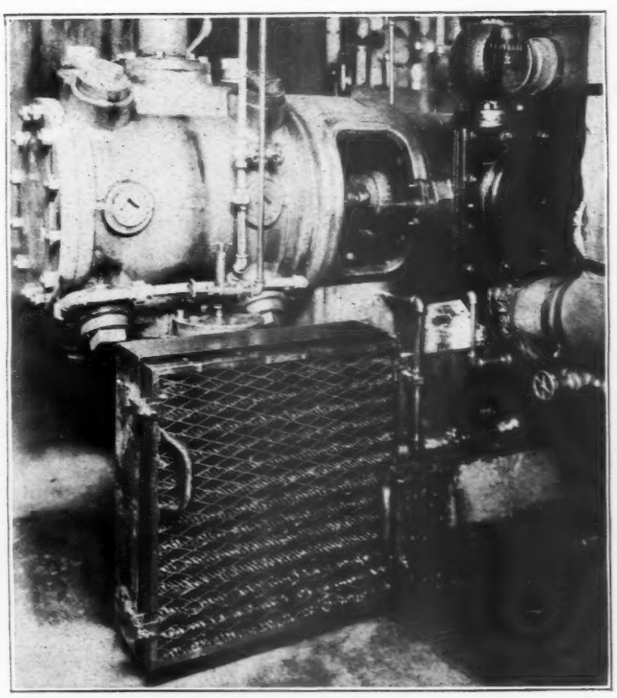
Many engines and compressors have been operating for five or ten years without filter protection and still appear to be giving satisfactory service. These, of course, are operating under practially ideal conditions.

In purchasing a compressor it is customary to select a size large enough to operate all the pneumatic equipment at the same time, and in addition to provide for future requirements. This is a good practice, but the result is that the compressor has a capacity from 15 per cent to 40 per cent in excess of air consumption, and a loss in volumetric efficiency of this amount can be caused by wear without being noticed. It is a difficult matter for the ordinary plant operator to check the volumetric efficiency of a compressor, and as a rule this is not attempted even when the equipment is new. If such checks were made every three or four years, there would be very few compressors operating for five years without reboring the cylinders, installing new pistons and giving them a thorough overhauling, unless they were protected by air filters. Wear on cylinders, pistons and piston rings permits compressed air to leak from one end of the cylinder to the other and results are excessive power cost and overheating.

The same analysis applies in a general way to engines. They are capable of carrying an overload without excessive heating and a considerable loss in compression due to wear can occur before they begin to give trouble.

In 1924 clean air was advocated by Barney Oldfield in an article which appeared in the June 1st issue of the Philadelphia *North American,* and the reasons he gives for cleaning air on automobile engines applies equally well to engines and compressors. The following is an excerpt from this article:

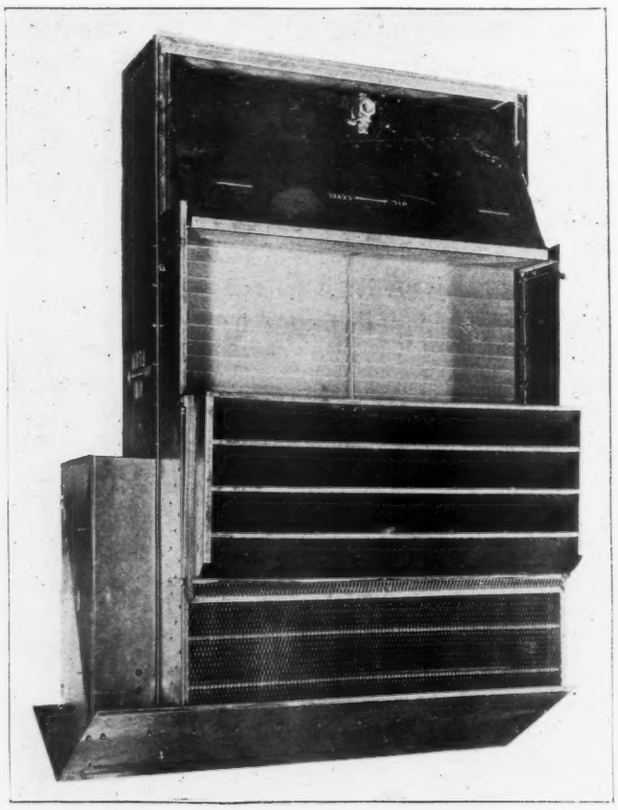
"Everyone who drives an automobile knows that carbon removal and valve grinding periods are all too frequent. According to tests made only about



Cell-type Filter Protecting Air Compressor.

3 per cent of the black deposit is carbon and the remaining 97 per cent is composed of various soluble compounds. The carbon mass in an engine comes from the gasoline, and the oil deposits some. The destructive part of the deposit is dirt that is drawn in thru the carburetor air intake. The dirt is responsible for much bearing, cylinder and piston ring wear. The only thing that will stop the dirt is an air cleaner, because that is the only way for dirt to get in."

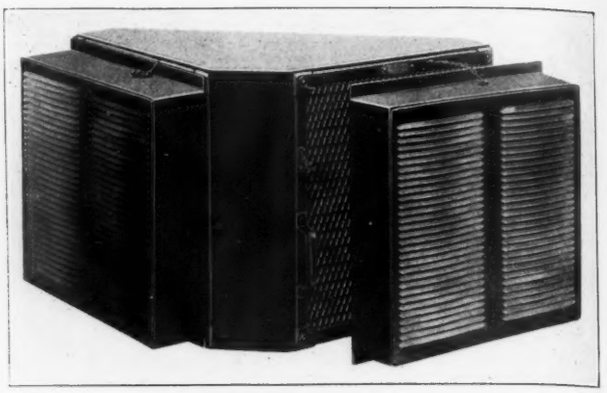
In this connection it is interesting to compare the service expected from an automobile and that required from an air compressor or Diesel engine. At an average operating speed of 20 miles per hour an automobile will travel 50,000 miles in



Multi-panel Automatic Air Filter with Weather Housing for Outdoor Installations.

2,500 hours. Most automobiles are discarded before they have been driven this far. On the other hand, an air compressor or oil engine in service only seven hours per day will run 2,500 hours in less than a year, and is expected to last ten or fifteen years at least.

In the last analysis, however, common sense demands that air filters be installed. According to well recognized authorities, the air in industrial districts contains from one grain to four grains of dust per 1,000 cubic feet. In order to visualize what a small amount of dust this is, picture a room 10 ft. high by 10 ft. wide and 10 ft. long; there you have 1,000 cubic feet. Now divide a pound of dust



A Cell-type Filter Showing Weather Louvres for Outside Mounting.

into 7,000 parts and distribute one of these parts uniformly in the air of this room and you have one grain of dust per 1,000 cubic feet. This air would appear quite clean. In fact, you could easily distribute twenty grains of dust in the same amount of air and it would not be visible except in a strong beam of light. This small amount of dust may seem insignificant until you figure it out for some particular engine or compressor; for instance, consider an engine or compressor the displacement of which is 2,000 cu. ft. per min. Operating ten hours per day, this machine will draw in eight million, four hundred thousand cubic feet of air in a week, which will contain 1½ pounds of abrasive dust, at one grain per 1,000 cubic feet, and a correspondingly larger amount at higher dust concentrations.

In a subsequent article a detailed description of some of the air filters used for the protection of

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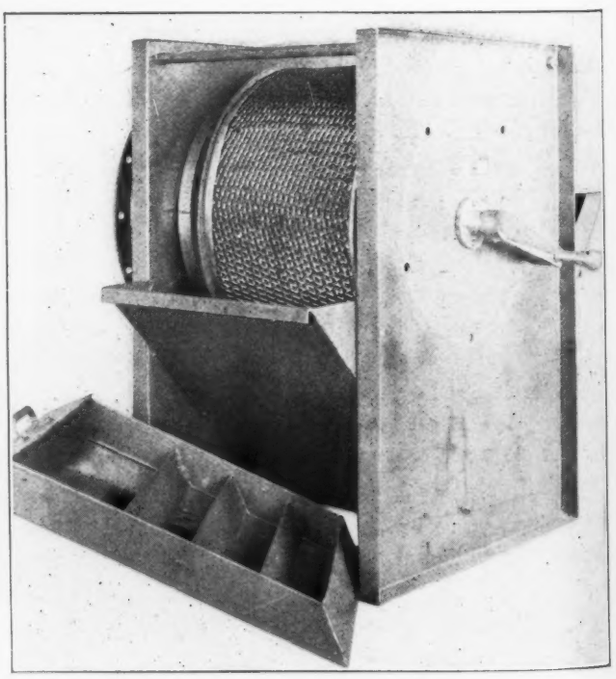


Semi-automatic Type of Air Filter.

Lime and Crushed-Stone Operations Successfully Combined in Modern Alabama Plant

Three Thousand Tons of Stone and Nine Hundred Barrels of Lime Made Daily

By W. E. TRAUFFER

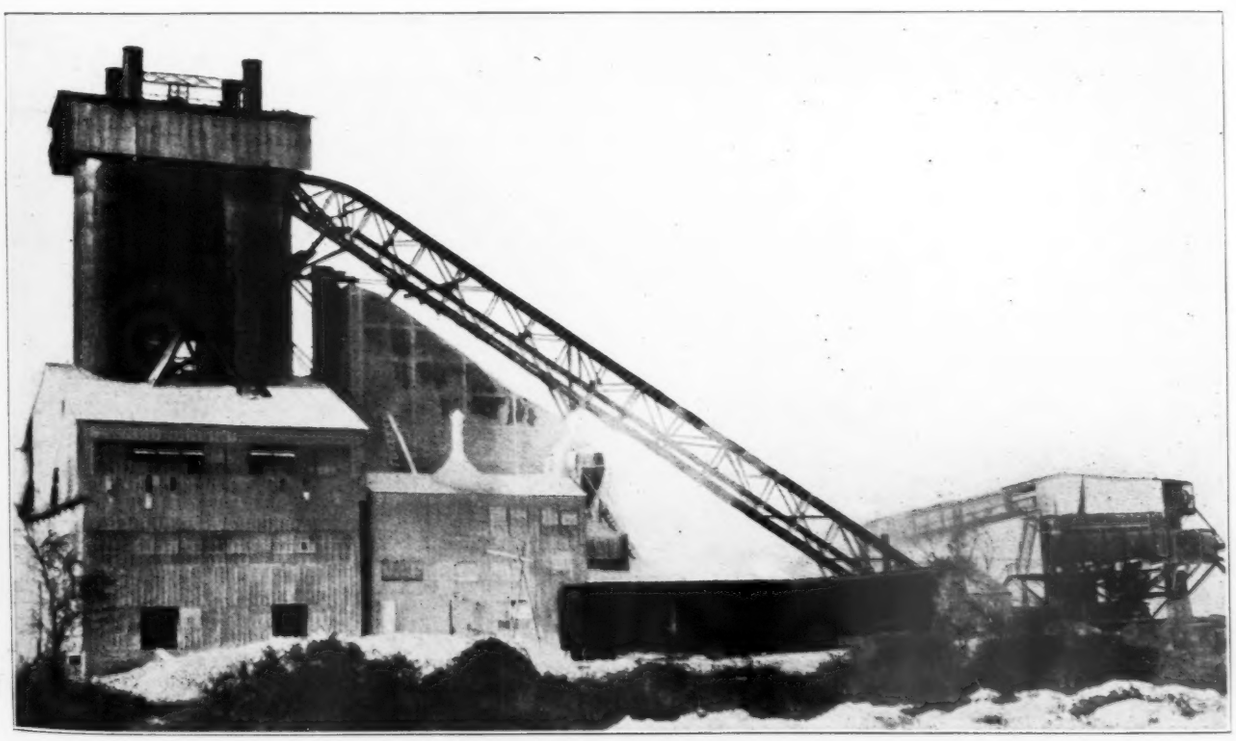
THE Alabama Lime & Stone Company operates a lime and crushed-stone plant at Calera, Alabama, which is one of the most modern operations in the South. The crushed-stone plant has been in operation about two years and the lime plant about a year. Both are of the very latest type of design and utilize the most advanced types of equipment. The plant site is in the famous Shelby County lime district which is known wherever lime is used. The crushed-stone plant is one of the very few in that part of Alabama. The stone plant has a capacity of 3,000 tons per day and the lime plant of 900 barrels in 24 hours.

Quarrying Operations

The quarry is located about 1,000 ft. north of the crushing plant. The overburden, which is about 10 ft. deep, was removed by a Bucyrus 14B ½-yd. shovel and hauled away to a dump. The limestone deposit had faulted at one time, causing the surface of the ground to be dotted with a large number of huge boulders and outcroppings which are partly buried in the overburden. This condition makes it impossible for the shovel to remove all the overburden. The remainder is shoveled out by hand and hauled away in two-wheeled carts drawn by oxen.

The stone varies considerably in different parts of the quarry. In addition to the stone used for building and road work there is some with a high calcium content which is used for lime making and some with a high magnesium content which is used for blast furnace flux. Three Ingersoll-Rand jackhammers and two Sullivan air drills using 18-ft. steel are used for drilling blast-holes on a face of about 40 feet. Hercules 40 per cent and 60 per cent dynamite and Cordeau-Bickford safety fuses are used.

The stone is loaded by a Thew 1¼-yd. steam shovel into 6-yd. Western side-dump cars. These are hauled one at a time up the incline from the quarry by an Ingersoll-Rand "Trigger" air hoist. Here they are taken over by a second hoist which hauls the cars up a trestle to the crushing plant. This track is all standard gauge. The high calcium stone for lime is loaded by hand into the same type of cars. These are hauled up the same incline from the quarry, at the top of which they are dumped into standard railroad gondola



Alabama Lime & Stone Company's Plant from Southwest; Lime Plant, Left; Crushing Plant, right.

Hauling Overburden by Ox Cart.

cars in which the stone is hauled to the lime plant. Any one-man size high-calcium stone on top of the deposit is hauled to the plant in the same ox-carts which haul away the stripping. The quarry is kept dry by two centrifugal pumps, one a 4-in. R. O. Wood and the other a 3-in. Krogh, the former being driven by a 20-hp. Westinghouse motor and the latter by a 15-hp. Crocker-Wheeler motor.

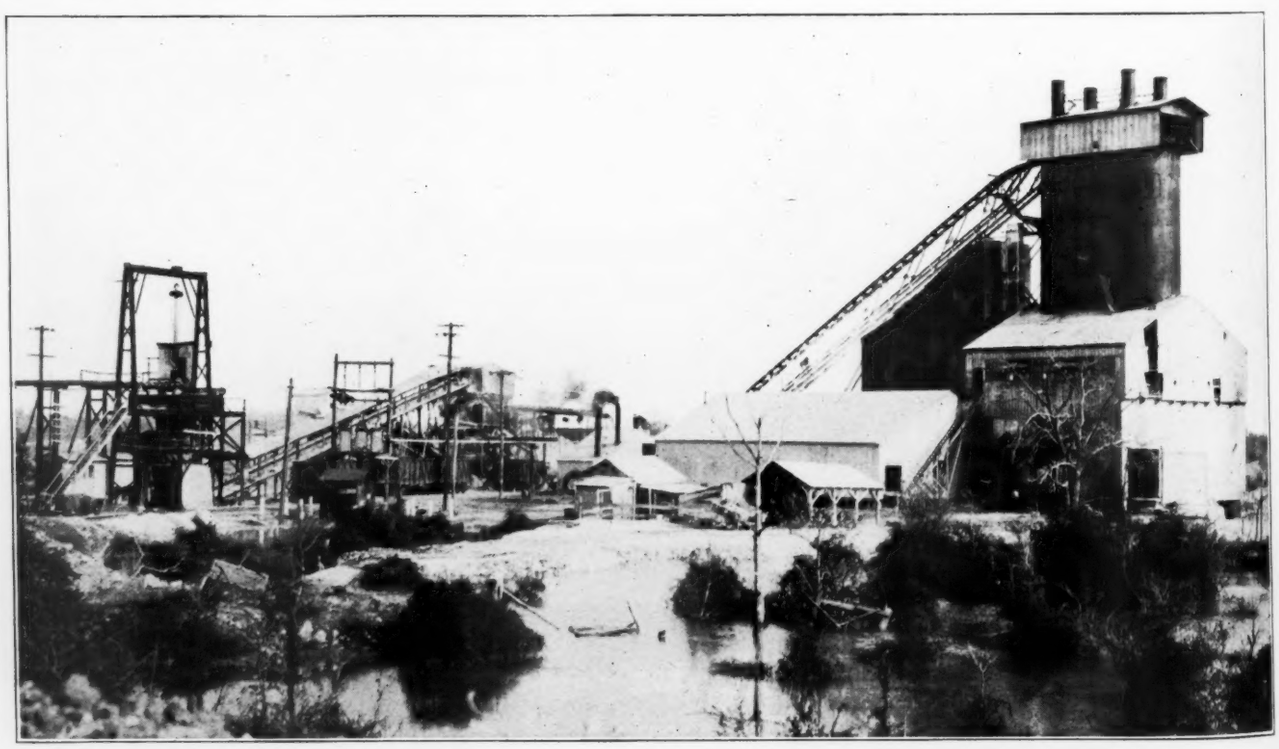
Crushing and Screening

The trestle to the crushing plant, in common with all the plant buildings and conveyor framework, is of structural steel construction. Concrete foundations are used throughout. The cars of stone are dumped by a small chain hoist into a steel hopper over the primary crusher. This is an Allis-Chalmers No. 12 gyratory crusher belt-driven by a 150-hp. Allis-Chalmers motor. The crusher discharges on to a 36-in. inclined belt conveyor on 250-ft. centers to the top of the screening building. This conveyor is covered by a corrugated metal roof. A larger chain hoist over the crusher is used to handle repair parts.

The conveyor discharges into a Kennedy-Van Saun 6-ft. by 28-ft. revolving screen equipped with a dust jacket. This screen is driven by a 75-hp. Fairbanks-Morse electric motor which also drives the conveyor from the crushing plant. The screen separates the stone into four sizes which go to a four-compartment steel bin, with a total capacity of 200 tons, under the screening plant. Two sizes 4-in. to 6-in. and 2½-in. to 4-in. are used for flux, the ¾-in. to 2½-in. stone is for road and concrete work, while the ¼-in. to 1¼-in. is also used for flux.

The arrangement of bins under the screen is such that when there is too much large-size stone it can be diverted into an Allis-Chalmers No. 6 gyratory crusher under the bins driven by a Fairbanks-Morse 20-hp. motor. The crusher discharges on to a 36-in. belt conveyor on 200-ft. centers which returns the stone to a transfer house, where it is discharged through a steel hopper on to the main conveyor from the primary crusher for rescreening.

The bins under the main screen have chutes and gates for loading into railroad cars for shipment. The bin containing the 4-in. to 6-in. stone also has a chute, so that this stone can be discharged on to a stockpile for the lime plant. A gate in the side of the bin containing ¼-in. to 1¼-in. stone feeds an 18-in. horizontal belt conveyor on 300-ft. centers,



Plant from Northwest; Crusher House, Left; Screening Building, Center; Lime Plant, Right.

Shovel Loading Cars in Quarry, Plant in Background. Railroad Car at Top of Incline Carries Stone to Lime Plant.

which distributes the stone on to a stockpile over a 300-ft. concrete tunnel.

The Dust Plant

The stone feeds through 22 gates in the top of the main tunnel on to an 18-in. belt conveyor on 300-ft. centers driven at its head end by a 10-hp. Lincoln motor through a Link-Belt silent-chain drive. This conveyor discharges on to a 24-in. inclined belt conveyor on 100-ft. centers to the dust house. This conveyor is driven at its head end by a Westinghouse 5-hp. motor through a Link-Belt silent-chain drive and discharges through a steel chute into a Williams hammermill. This is driven by a 75-hp. Westinghouse motor through a flexible coupling and discharges into a belt bucket elevator. The elevator feeds a 4½-ft. by 18-ft. revolving screen which separates the material into two sizes, ¼-in. to ¾-in., and ¼-in. down. These discharge into two steel bins from which they can be loaded into either cars or trucks. The larger size is used for concrete work and the smaller size for agricultural purposes. The bucket elevator is driven by a Wagner 10-hp. motor through a Link-Belt silent-chain drive and the revolving screen by a 20-hp. Fairbanks-Morse motor.

The Lime Plant

The stone in the lime stockpile discharges through four gates into a 3½-ton capacity steel car in a short concrete tunnel under the railroad tracks between the stockpile and the lime plant. This car is pulled by a cable to and up an incline to the top of the lime kilns. This incline is of structural steel and has an arrangement for bringing

Dumping Carload of Stone Into Primary Crusher.

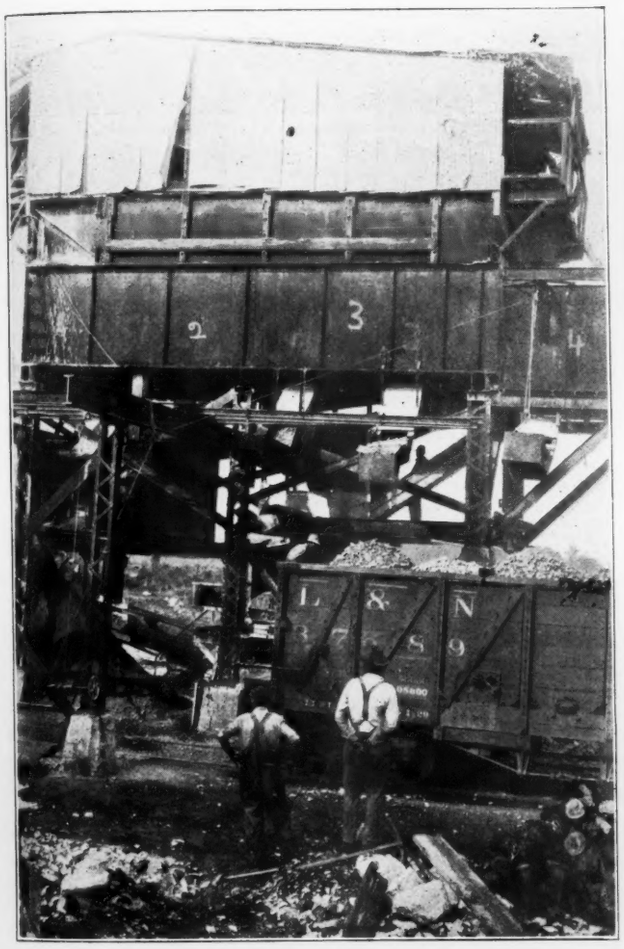
Primary Crusher and Screening Plant. Cartload of Stone f rom Stripping Being Hauled to Lime Plant.

the emptied car back from the top of the kilns to the incline. A bar of iron fastened to the cable near the car as it passes over the top of the incline catches a ring on a second cable which pulls up a small weighted car on a second track under the main track. When the car is emptied into the kiln the hoist brake is released and the weighted car pulls the empty car back to the top of the incline where it is lowered to the pit by gravity with the hoist acting as a brake.

The lime plant is of the same modern type of construction as the stone plant. The foundations are concrete and the superstructure corrugated metal on structural-steel framework.

Kiln Drawing Floor in Lime Plant. Hydraulically-operated Shear Gates Above, Enclosed Elevator to Bins in Center with Packing Spouts in Background.

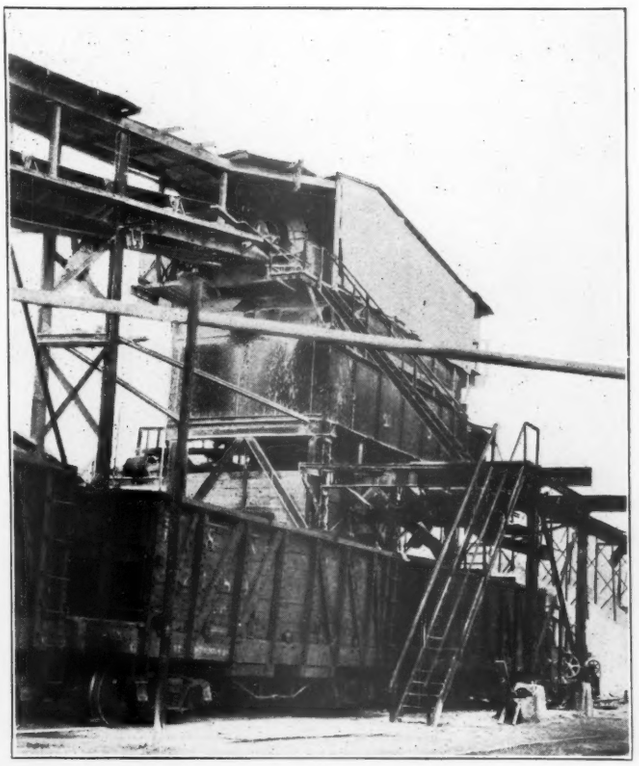
The stone is fed into the kilns through openings having special doors which are closed between charging periods. The two Schaffer automatic kilns are each 90-ft. high and 17-ft. 4-in. in diameter and have a combined capacity of 900 bbl. in 24 hours. They are kept filled to the top and are drawn at intervals by hydraulically operated shear gates, six barrels being drawn at one time. Coal is used as fuel and the kilns are fired by a stoker of Schaffer design. The specially designed automatic stokers are controlled by a clock which gives a periodic operation similar to hand firing.



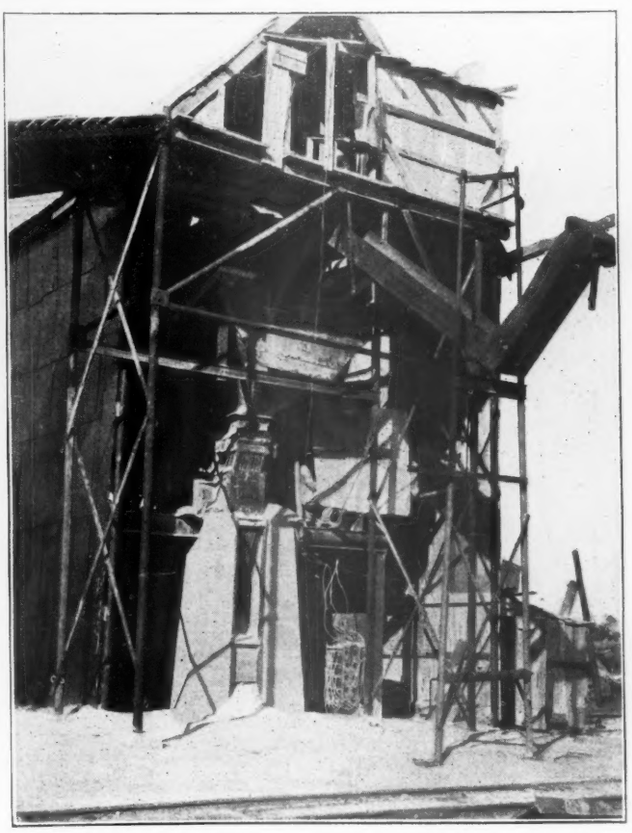
Close-up of Screening Building Showing Car Being Loaded.

Each of the kilns when full has the equivalent of 376 tons of stone in the process of manufacture. The interior of the kiln is of a different shape from that of any other kiln and has preheating, acidulating, fireless calcining and cooling sections. A special flue arrangement gives the kilns a high draft even though an exceptional quantity of raw stone is carried in the top.

The kilns discharge on to a concrete floor where the spalls are sorted out. The well-burned stone is shoveled into a Jeffrey single-roll crusher under the floor, driven by a 25-hp. motor. The crusher discharges into a Jeffrey enclosed-chain elevator which elevates the crushed lime 90-ft. into a 1,500-ton capacity steel bin. A screen allows only the coarse material to drop into the bin. The lump lime is loaded into barrels and jute bags from five spouts under the bin. Weighing is done on a port-



Cars Being Loaded from Bins Under Screen.



Close-up of Dust Building with Hammer Mill on Concrete Foundation.

Concrete Conveyor Tunnel at Left, Dust House at Right.

able platform scale. Lime can also be loaded directly into cars in bulk through three spouts running at a 45 deg. angle from the bin.

The fine material passing through the screen over the lump-lime bin goes through a chute into a steel storage tank over the Schaffer hydrator. The hydrator is driven by a 25-hp. Allis-Chalmers motor through a Link-Belt silent-chain drive, the Raymond air separator by a 25-hp. motor and the Raymond pulverizer by a 10-hp. Lincoln motor. The finished lime goes to a Bates two-bag packer which is driven by a 7½-hp. Lincoln motor.

A small building near the primary crushing plant houses an Ingersoll-Rand Imperial Type 10 air compressor with 14-in. by 12-in. and 9-in. by 12-in. cylinders. This is belt-driven by a Westinghouse motor. A small blacksmith shop near the quarry is used mostly for drill sharpening. All switching at the plant is done by a Davenport saddle-tank locomotive.

H. C. Hill is quarry superintendent, John Nix is superintendent of the stone plant, and W. J. Findley is superintendent of the lime plant. The main offices of the Alabama Lime & Stone Company are in the Martin Building, Birmingham, Alabama. The officers are E. T. Schuler, president; R. N. McDonough, vice-president and general manager; and Frank W. Miller, second vice-president.

National Sand & Gravel Manufacturers' Division to Hold Annual Meeting

The annual meeting of the Manufacturers' Division of the National Sand & Gravel Association will be held at the Pennsylvania Hotel, New York City, beginning with dinner at 6:00 p. m. on the evening of Tuesday, September 17. The meeting will extend over until the following day, at which time plans will be considered with reference to the forthcoming exhibition at the annual convention of the association in Memphis, Tennessee, on January 28, 29, and 30, 1930.

It has been the practice heretofore to elect officers of the Manufacturers' Division at the time of the annual convention of the association. It has been felt, however, that it would be more desirable to elect officers at the annual meeting of the division. Under these circumstances, a nominating committee has been appointed to recommend candidates for the various offices and a report will be submitted for final consideration at the meeting in New York on September 18.

Efficient Air-Cleaners Are Necessary

(*Continued from Page* 64)

engines and compressors will be given. Generally speaking, however, commercial air filters consist of a filter media made up of a mat of crimped wire, or sheets of expanded metal coated with oil and the dust is removed by causing the air stream to impinge against these oil coated baffles, where it is held by the oil. Two types of filters are in general use. The cell type as illustrated in Fig. 1 has to be removed at intervals varying between four and six weeks, and cleaned by washing in hot water, kerosene or gasoline. After washing it is recharged by dipping in oil. There is also the automatic air filter as illustrated in Fig. 2, which requires no maintenance attention except occasionally changing the oil in the oil reservoir, and the semi-automatic type illustrated in Fig. 3, which is cleaned by revolving the drum with a hand crank.

Interest in lime and cement deposits near Lakeview, Oregon, has been revived since representatives of a mining syndicate analyzed samples and foun dthem of high grade. The deposits are extensive, and one of the mining engineers said that the cement deposit was the largest of its kind he had ever surveyed.

Rebuilding of Old Plant Results in Larger Output, Better Grading and Increased Economy

Bloomville Quarry Produces Crushed Stone, Building Stone and Agricultural Limestone

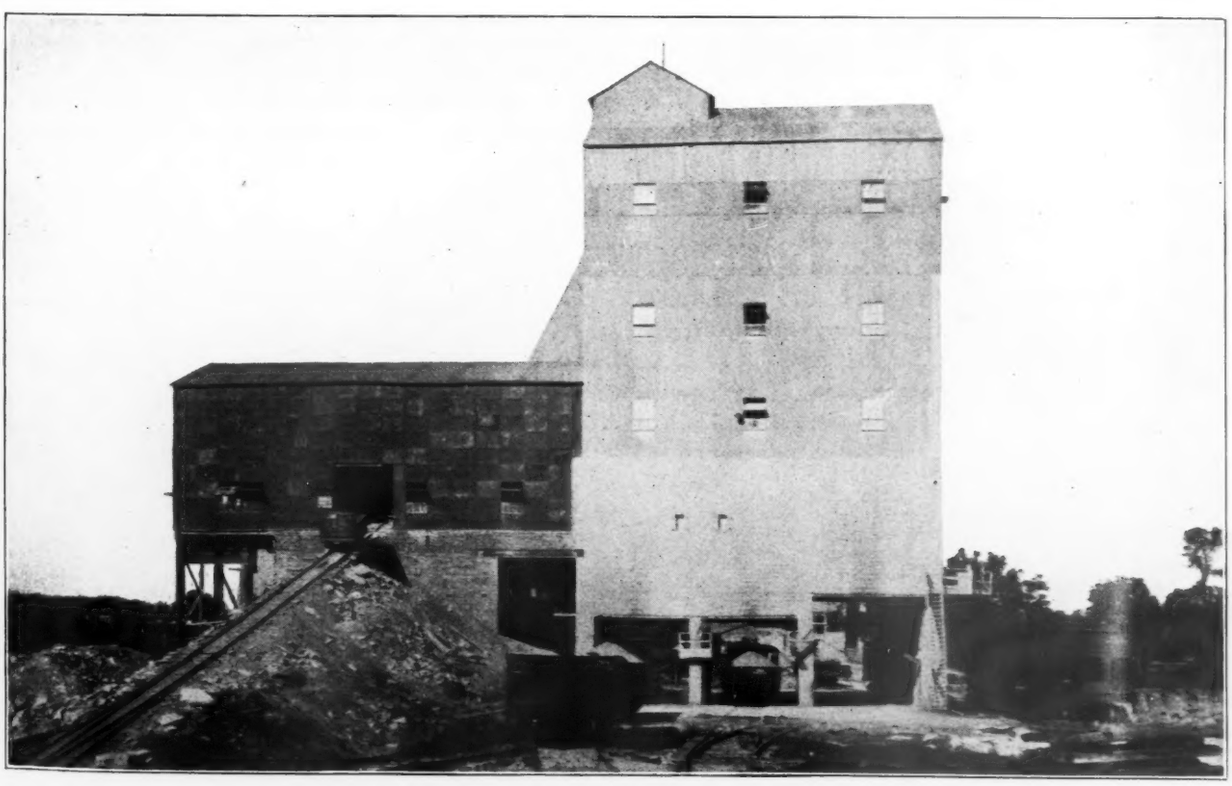
By THOMAS R. COLLINS

THE Bloomville quarry of the France Stone Company is located at Bloomville, Ohio, about thirty-six miles southwest of Sandusky. Early this year it was equipped for screening exclusively by gyrating screens. The new installation consists of a complete set of Simplicity screens (replacing three rotary screens with double jackets), one 5-ft. by 24-ft., and two 4-ft. by 24-ft., operated by a 50-hp. General Electric motor. According to G. C. Adams, district superintendent, these new screens have resulted in economy of operation, greater production capacity, and better grading of material. In his own words, "they handle material better and produce a higher grade product with less expense."

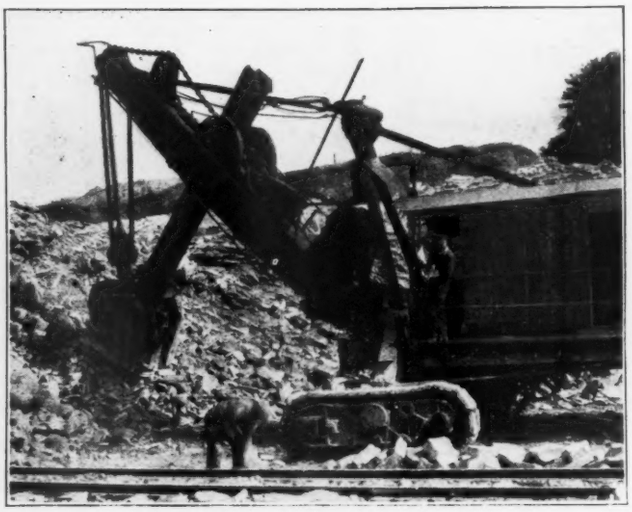
This entire plant was rebuilt about two years ago. The old building remained intact while the walls and roof of the new building were being erected around it. During the reconstruction work operations were carried on as usual. Installation of the gyrating screens, which is the latest improvement, has brought this plant to a high state of efficiency.

New Office Building with Truck on Scale.

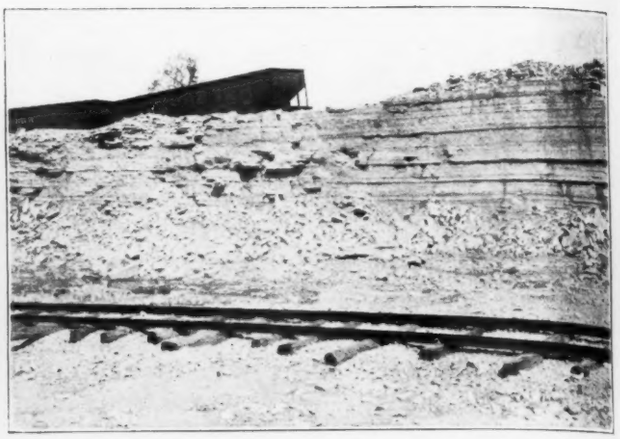
This quarrying and crushing plant is located on the Pennsylvania Railroad. The company owns one square mile of land, of which about eight acres have been excavated and worked. This is the original plant of the France Stone Company, whose



Crusher House and Car Going Up Incline at Plant of France Stone Company, Bloomville, Ohio.



Steam Shovel in Quarry.



Rock Face in Quarry; Note Even Stratification.

home office is in Toledo, and was opened about thirty-five years ago. The company operates more than twenty various-sized quarries and crushing plants in the vicinity of Toledo. About thirty-five men are employed at this plant, which operates the year around (except in extremely cold weather), an average of about ten months a year full working time being maintained. The capacity is approximately 1,600 tons per 10-hour day.

The stone deposit here is a hard, blue limestone that makes excellent road and building material. The first bench only is being worked. It is about 24 ft. deep and the stone runs uniform throughout the area. A number of tests indicate that the second bench, consisting of the same kind of stone, runs well over 100 ft. deep. The overburden runs from 10 to 22 ft. thick, with an average of 16 ft. It is removed with steam shovels and hauled to the dump with a dinky locomotive and dump cars.

One of the original features of this plant is the process utilized in removing the overburden. A Mack truck with dual-reduction gears mounted on car wheels and operating on a railroad track is used. The truck wheels were removed and steel locomotive wheels put on. The fact that the Mack truck has the same gauge as standard locomotives made it possible to do this by using only standard parts. A special reverse transmission gear was installed, making it possible to run the truck backward as fast as forward; also a differential three-way dump gear was installed under the body so that the load could be dumped at either side or the end. This truck is easy to operate and works on the same principle as any other gasoline truck. It holds 4 cubic yards. The chief characteristic of this contrivance is its simplicity and ease of operation. With it, stripping operations can be carried on by two men—one on the shovel and one on the truck—although ordinarily three men are used—one on the shovel, one on the truck, and one on the dump. A photograph reproduced here shows

Steam Shovel in Quarry Loading Train of Dump Cars.

Steam Locomotive Used for Switching at Plant and Storage Yard.

Primary Crusher and Overhead Track for Bottom-dump Cars.

this truck in operation at the Republic quarry, a small local plant opened by the company about a year ago. This truck, incidentally, is used for stripping at a number of the France quarries in this vicinity. To move it from one location to another the car wheels are taken off and the truck wheels put on. This operation takes about thirty minutes and can be done by one man.

In the quarry a Marion Model 91 steam shovel is used to pick up the stone and load the dump cars. It uses a 3½-cu.-yd. dipper and a 1⅝-in. chain. A Marion Model 21 gas-electric shovel also is used to transfer materials to the storage piles, for loading for them, and for stripping. After the ledge has been shot, this stone is sufficiently broken so that no further breaking is required except in rare instances, when a jackhammer drill is used. This process is so seldom necessary that only one jackhammer drill is in operation at this quarry.

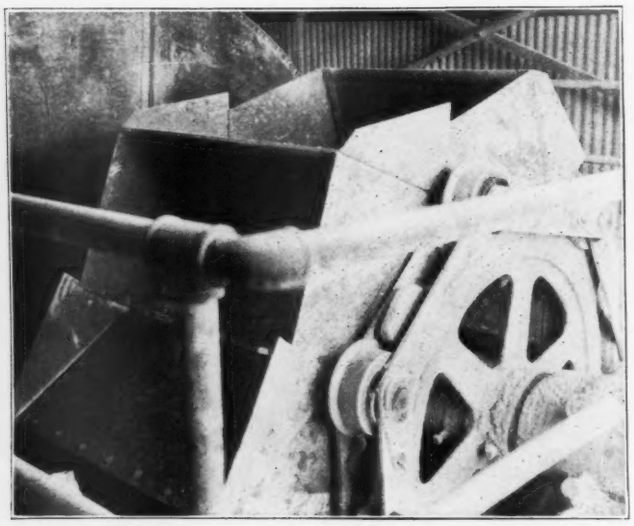
A Loomis well drill with 5⅞-in. bits is used. The holes are sunk to the bottom of the first bench, averaging about 24 feet. From 60 to 100 holes are shot in one operation with about 125 lb. of Du Pont dynamite for each hole. Shooting is done in the evening after the quarry has closed for the day.

For hauling stone in the quarry, also for occasional removal of overburden when that work is in process, 24 end-dump cars, with wooden bodies holding 4 cu. yd. each, are used. These were made by the Watt Mining Car Wheel Company.

Motive power is furnished by two dinky steam locomotives, one 18-ton Porter and one 27-ton Vulcan. The former is used in the quarry, and the latter for moving railroad cars around the crusher house and throughout the storage yard. For temporary storage and for transferring material two Blaw-Knox bins are used, one of 60-ton and the other of 90-ton capacity. The cars are pulled up an incline into the crusher house by an old steam Lidgerwood hoist converted into an electric drive.

Type of Truck Used in Company's Quarries.

Crusher House and Incline.



Top of Pan Conveyor from Primary Crusher to Screen.

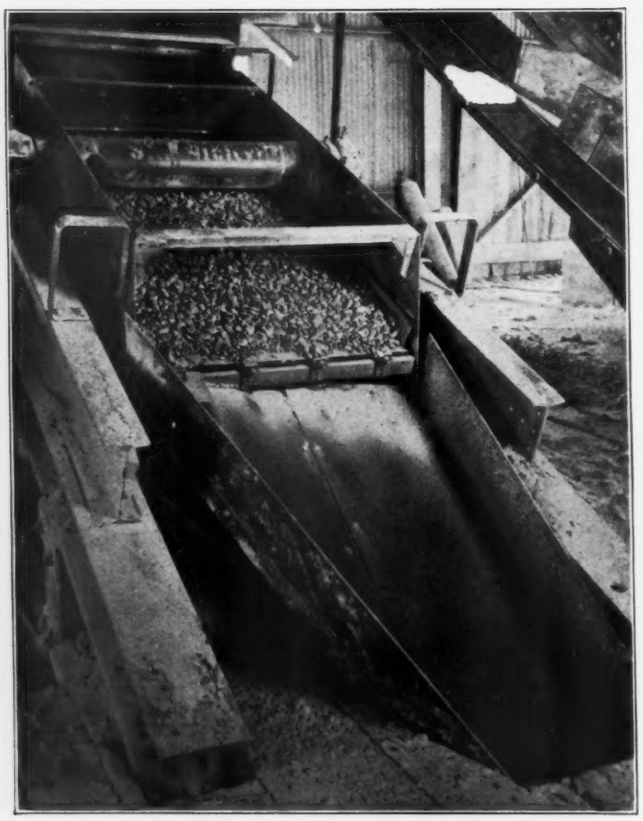
It is equipped with a Texrope drive and is operated by a 60-hp. General Electric motor.

For the primary crushing the stone goes through a No. 8 Allis Chalmers Gates crusher, which has a 16-in. opening. It reduces the stone to about 5-in. and smaller. This crusher is operated by a 150-hp. General Electric motor operating from a line shaft. One of the difficulties experienced is that slabby stone sometimes gets through the crusher. With the old screens these smaller slabs frequently went through, but the new screens have eliminated this trouble to a large extent. If the slabs come through in a wedge shape, they sometimes catch in the screen and must be removed by hand.

For the tailings and secondary crushing a 4-ft. Symons cone crusher is used. It is operated by a 100-hp. General Electric motor run with a Texrope drive. From the crusher the material is conveyed to the screens by a 36-in. superpan conveyor, with 107-ft. centers, made by the Webster Manufacturing Company. It is operated by a 40-hp. General Electric motor. A Cleveland worm-gear speed-reducer is used. It is equipped with a magnetic brake which keeps it from reversing when the power is shut off.

The new screens were made and installed by the Simplicity Engineering Company. They consist of one 4-ft.-by-8-ft. double-deck and two 4-ft.-by-8-ft. single-deck screens set in tandem, and two 3-ft.-by-6-ft. single-deck screens. The stone goes first to the 4-ft.-by-8-ft. double-deck screen, where the rejections and the No. 1 grade are taken off. From that screen the rest of the stone passes off and goes to the two 4-ft.-by-8-ft. screens set in tandem, where the No. 2 and No. 3 grades are made. Everything passing the bottom jacket of these screens goes to the two 3-ft.-by-6-ft. screens, which make the Nos. 4, 5, 6, and 7 grades.

Locomotive Crane Which Handles Materials in Stockpiles.



One of the Vibrating Screens.

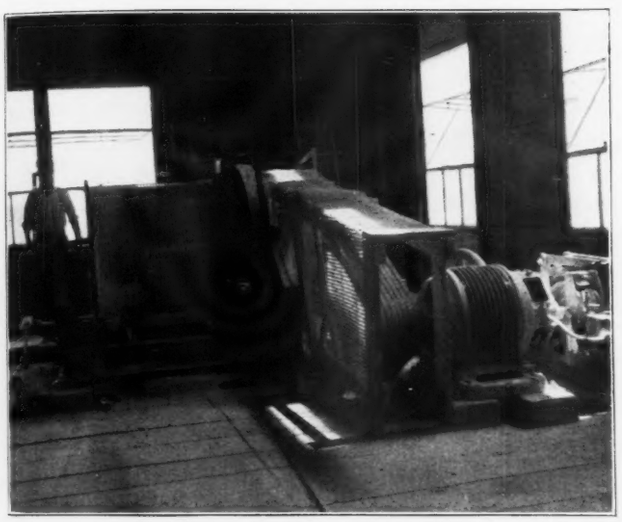
The top deck of the top screen has a 4½-in. mesh and the lower deck a 3-in. mesh. The next two screens have 1½-in. mesh on top and 1-in. mesh on the bottom. The two 3-ft.-by-6-ft. single screens have a ⅝-in. mesh on top and a ¼-in. mesh on the bottom. These sizes are standard and the screens can be arranged for other sizes as different or unusual specifications are desired. The ordinary change can be made in about thirty minutes. Motive power is furnished by direct-connected individual motors. On the 4-ft.-by-8-ft. screens 5-hp. Fairbanks-Morse motors are used and on the 3-ft.-by-6-ft. screens 3-hp. General Electric motors.

This shows a considerable reduction in electric power consumed by the old screens which required a 50-hp. motor.

The new screens, which were installed this spring, have given perfect satisfaction. The top screen receives all the stone from the No. 8 crusher, also the rejections and sometimes Nos. 1, 2 and 3 grades from the Symons crusher.

During the period April 11 to May 16 inclusive the screens handled 32,989 tons of crushed stone into the following grades: No. 1, 3,769 tons; No. 2, 2,719 tons; No. 3, 8,312 tons; No. 4, 5,481 tons; No. 6, 7,435 tons; No. 7, 5,273 tons.

From the screens the rejections are carried to the Symons crusher by a 24-in. trough-conveyor

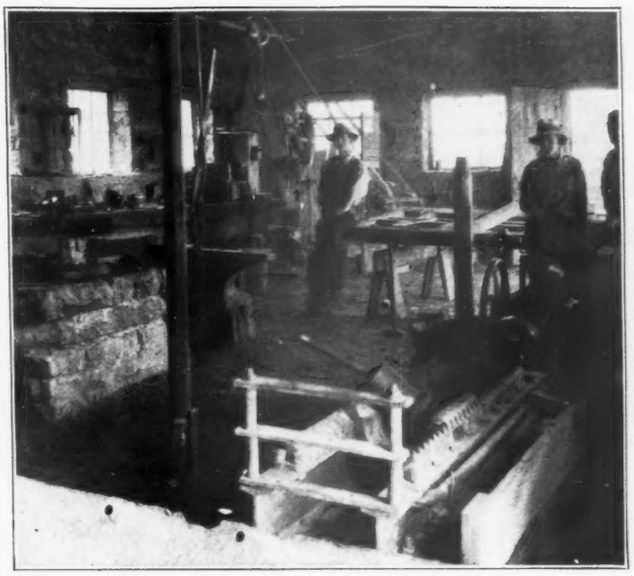


Hoist Which Pulls Cars Up Incline to Crusher.

belt, 70 ft. long. It is operated by a 5-hp. General Electric motor and is equipped with a herringbone speed-reducer. The various grades are carried to the storage bins by wooden chutes. The chutes and bins are arranged so that when the bins fill up, the stone backs up in the chute and the surplus is automatically returned to the Symons crusher for further reduction. By three turn gates, made by the Webster Manufacturing Company, the stone can be directed into any chute desired, thus enabling the operator to make any mixture required with a minimum number of chutes. For storage eight concrete bins are used, with a total capacity of 1,200 tons.

To remove the material to the open-storage piles a Mack truck is used. An Ohio 20-ton locomotive crane, made by the Bucyrus Manufacturing Company, is used for transferring the material, and a 5-ton Sterling truck is used in the quarry. Ordinarily about 75,000 tons of material is carried in open storage. For light hauling and for running errands around the plant a Ford truck is employed.

A modern machine-and-blacksmith shop, housed in a stone building adjacent to the crusher house,



Interior of Blacksmith Shop.

is equipped for the repair work, to sharpen bits and to do all the blacksmith work. This building and the one housing the electric equipment were erected with stone taken from the local quarry. The machine shop is equipped with Marvel power hack saws, power drills and an Armstrong bit-dressing machine.

One of the unusual products of this plant is the building stone, which is taken from the quarry and shaped by hand. The stratification in the quarry is such that, throughout the face of the first ledge,

Some of the Double-deck Vibrating Screens.

Building Blocks That Are Worked Up by Hand.

the stone is even and of the proper thickness to be made into uniformly sized blocks. The ledge is shot in the usual manner and the stone suitable for building purposes is selected, thrown alongside the track, and there worked up by hand, after which it is carried by dump cars and truck to open storage, whence it is shipped to the user. This is the only property of the France Stone Company furnishing this sort of stone in any appreciable amount, although a limited quantity has been taken from the White House quarry southwest of Toledo. For this purpose the stone offers unusual characteristics in that every side of a block presents a natural rock face. The blocks come in various sizes which, when placed in the wall of a building, provide a variation that makes a very pleasing effect. The stone comes in blue, gray and buff colors, and the use of the different colors provides an additional variation. Unlike other building stone, it retains its color and texture through all sorts of weather conditions.

Among the buildings constructed of this material are some of the Heidelberg College buildings and several churches in Tiffin, many churches in Toledo, and a number of churches and schools in Detroit and surrounding suburbs. Gar Wood, the speedboat king, has a home in Detroit built of this material. Shipments are made into northern Indiana, northern Ohio and southern Michigan.

As a practical exhibit of what can be done with this stone, the company has on display its new office building, built entirely of this material, each wall presenting a different method of laying up the blocks. This building has a 21-in. wall. A 2-in. air pocket is used with a brick backing, the bricks having been salvaged from the old steam boilers at the time the plant was changed from steam to electric power.

The thinner slabs of building stone are used for stepping stones and irregular flagstone sidewalks around residences.

One of the pleasing features of the crushed stone produced by this plant is the fact that the stone in place is clean with no mud pockets. This assures a clean and evenly-graded stone without washing. It is used for road work, concrete, and railroad ballast. Some agricultural limestone is produced, this product being caught by the dust screens. This

(*Continued on Page* 80)

Storage Yard on Quarry Floor.

Ohio's Erstwhile "Sandstone Center of the World" Reasserts Its Old Claim to Greatness

The Merger of Two Old Companies Gives the District First Place in Sandstone Production

By R. H. CLIFFORD

AMHERST, OHIO, where millions of tons of sandstone—Ohio's most famous and valuable rock deposits—has been produced, has indications of becoming the real sandstone center of the world, at least its citizens entertain such a hope. Amherst sandstone was famous 75 years ago, when grindstones cut from Lorain County quarries were to be found on thousands of farms in the United States. From the scores of quarries which surrounded the town of Amherst more sandstone was shipped than from any other part of the world, and Amherst then laid claim to the title of "Sandstone Center of the World," this slogan having been set up in front of the town hall and on the surrounding highways.

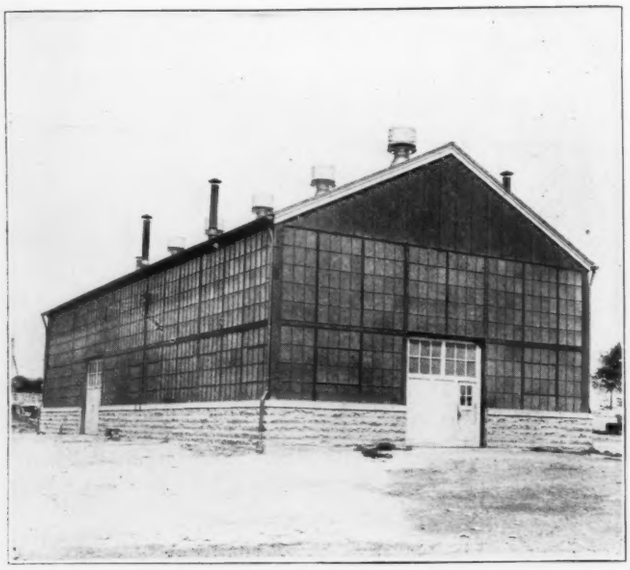
In recent years, however, many of the quarries have been abandoned. Development of carborundum and other intensely hard products of the electric furnace made the use of grindstones obsolete. Brick and tile also cut into the stone market and, although the quarries continued to send out millions of tons of stone annually, the sandstone industry was no longer dominant.

But recent events have wrought a change. A merger of the Cleveland Stone Company and the Ohio Quarries Company, consummated within the past few weeks, gives the district the largest sandstone company in the world. The two concerns had operated as competitors in and near Amherst for more than a quarter of a century.

Amherst sandstone is remarkable for its great strength and freedom from flaws and breaks. Jay Terrill and G. Frederick Wright, writing in histories of the county, refer to the sandstone deposits in the vicinity of Amherst as the most remarkable in the world, from both the geographical and economic points of view. Amherst County sandstone is able to resist pressures much greater than brick, marble and granite can withstand. Its durability, according to Terrill, is greater than that of any other sedimentary rock. It resists the erosive action of the elements to a wonderful degree and is not appreciably affected by weathering. It also has unusual fire-resisting qualities.

It was originally known as Waverly sandstone, from a town in the southern part of Ohio, where

This Sandstone Quarry of the Cleveland Quarries Company Is Over One Mile in Circumference and Has Been Worked More Than Fifty Years.



The Blacksmith Shop.

an outcrop was extensively quarried for use in building the locks of the Ohio Canal. In geological records it is also known as Berea grit, since it was in Berea, Ohio, that it was first quarried for grindstones. In later years, however, it has become more familiar as Amherst sandstone.

Early quarrying activities in this locality reached their peak in the period following the great Chicago fire of half a century ago. Faced with the task of rebuilding, the midwest metropolis selected Amherst as the closest available source of stone building material. One quarry after another was blasted open, a short railroad was built from the quarries to Lake Erie, three miles north, piers were constructed, and in two years millions of tons of stone were loaded on boats for shipment to Chicago. With that city rebuilt, the railroad, piers and many of the quarries were abandoned, yet remains of the piers and the road can still be seen.

Stone from these quarries was used in some of the finest buildings of a generation ago in New York, Boston, Chicago, and St. Louis. The Parliament buildings of Canada were built of Amherst sandstone. Lorain County itself has made extensive use of its native stone for building purposes. Some of the examples are the courthouse in Elyria, Amherst town hall, and Lorain post-office.

Vast as has been the quantity of stone taken from these pits, it is insignificant in comparison with what remains, according to experts. Hundreds of men, assisted by the giant slave, steam, toil on the ledges and in the pits, taking out the rough stone, which, under the chisel of the artisan, assumes shapes of grace, beauty, and strength.

W. A. C. Smith, Cleveland, president of the former Ohio Quarries Company and now chairman of the board of the combine, predicts a boom for the Amherst sandstone industry and announces plans for expansion and improvements. He adds that the combined companies which, between them, had controlled practically all the quarries in the district, would provide employment for 1,200 men this season. He estimates that 5,000,000 cu. ft. of stone, exclusive of the various by-products, such as curbing, flagstones and sand, will be produced this year.

With the exception of one newly-opened quarry at Birmingham, about six miles from Amherst, all the Lorain County quarries now being worked by the combine are in the vicinity of Amherst, South Amherst and Brownhelm, and so are within a few miles of each other. They include both the deepest and the largest quarries in the United States. The former is 212 ft. deep, while the latter, which has been operated for more than fifty years, is more than a mile in circumference.

H. W. Caldwell, Cleveland, who was president of the Cleveland Stone Company, is head of the merged companies, known as the Cleveland Quarries Company. Howard Delmedge and Paul Morie are superintendents in charge of operations of the quarries. Other officers are F. D. Kellogg, executive vice-president; and J. R. Miller, treasurer.

T. A. Giberson, Vice-president.

J. R. Miller, Treasurer.

R. H. Clifford, General Superintendent.

The "Buckeye Gray," Said to Be the World's Largest Sandstone Quarry.

The Cleveland Stone Company was organized in 1886 and the Ohio Quarries in 1903. At the time of the merger they owned or controlled a great part of the sandstone deposits in the county, as well as quarry land near Berea and in Erie County. The Ohio Cut Stone Company operates in Amherst. Mr. Smith is president of this firm also, so it is expected that eventually it will join the merger.

Paul Morie, one of the superintendents, has stated that operating methods in the two famous quarries—the largest and the deepest—are similar to those employed in customary quarrying activities in smaller pits. Approximately 5,000,000 cu. ft. of compressed air, transported through six miles of air lines, is used daily by workmen in channeling and drilling the stone deposits. Of this amount, 400 cu. ft. per min. is used on the channeling machines and 140 cu. ft. per min. in the jackhammer drills.

From the numerous quarry pits on the property slabs of stone weighing from five to twenty tons are cut with the channeling machines and jackhammer drills and then hoisted to the ground with motor-driven derricks. There they are loaded on flat cars and taken to the sawmills to be cut into the required sizes for curbing, flagstone, and building stone.

The company operates five saw mills, employing a total of 100 men engaged exclusively in cutting the stone into required sizes. The two largest, the only two of the five in continual operation, are ultra-modern in every respect and have a total of twenty-five sawing machines. The long steel saw blades, which descend slowly on top of the stone under an automatically-operated turning device, are ¼ in. thick and cut an average of 9 in. an hour. As many as thirty blades may be operated on the machine at a time, depending on the size of the stone to be cut. Lime, water and silica sand drip continually on the blades as they cut into the stone. Ten of these machines are located in one mill and fifteen in another. They are operated by individual electric motors.

The finished curb work is done in the planing mill, where special quarters are providing for turning out curbstones. Grindstones, ranging in size from that of an ordinary watch-fob to those seven feet in diameter, are made in the grindstone mill.

In the company's planing mill there are twenty-four machines, each of which turns out finished curb at the rate of one section every 7 min. Sections are between 5 and 7 ft. long, weigh about half a ton each, are 5 in. thick and about 20 in. deep. The raw curbing, cut from the huge slabs in the sawmills, is first hoisted to the dressing bed of the planing machine and then the facing tools, consisting of three sharp and one pronged instrument, are scraped over the stone to make the "face." When this is finished, the "bullnose," a rounded pronged tool, cuts into one side to make the rounded edge of the curb and the job is completed and ready for shipment. Only two men, an operator and his helper, are required to keep these machines running. All the waste from these curbstones is deposited on a conveyor under the machines, carried

to an adjoining sand crusher, and then deposited in a bin from which it is dumped into waiting gondola cars for shipment to steel plants which use it for furnace beds.

The quarry blacksmith shop, which is regarded as one of the showplaces on the grounds, is equipped with five furnaces and six forges, in addition to stockrooms, an office, and lavatories. This shop, constructed of stone, steel, and glass—instead of the ordinary wooden shacks so often used for quarry blacksmith and repair work—is 80 by 120 ft. in dimension, and is arranged with doors on both sides so that trucks can drive through the structure with equipment and materials.

California Sand, Gravel and Stone Companies Form $20,000,000 Merger

The second large consolidation of leading sand, gravel and stone companies in California, as told in these columns recently, has been completed. A group of northern and southern California banking and industrial leaders effected this combine after more than a year's preparation and negotiation. By this action the Pacific Coast Aggregates, Incorporated, becomes one of the world's largest sand, gravel and stone companies. The properties involved are valued at $20,000,000. The merger contracts were closed on July 19 in San Francisco.

The merger, it is claimed, will result in important savings to both stockholders and consumers. The reductions in costs will arise from the elimination of cross hauls by rail and truck, of overproduction in the territory, and of large items of expense in selling and administration.

Banking executives are expected within a few days to issue a formal announcement of the complete consolidation program.

The companies included in the merger handle the bulk of the sand-and-gravel business in San Francisco, Oakland, Sacramento, Stockton, Berkeley, Fresno, Alameda, Richmond, San Jose and other communities. The territory to be served is estimated to contain one-half of the population of the state. In addition to their products these companies handle complete lines of cement, lime, brick and other building materials.

The companies included in the merger are: Acme Gravel Company, Associated Gravel Company, American River Sand & Gravel Company, American Sand Company, Bay Development Company, T. I. Butler Company, California Rock Company, Coast Rock & Gravel Company, G. & M. Gravel Company, Piedra Rock Company, California Building Material Company, Pratt Building Material Company, Pratt Rock & Gravel Company, Rhodes-Jamieson Company, River Sand & Gravel Company, Santa Clara Gravel Company, and Vulcan Rock Company.

Rebuilding Old Plant Results in Economy

(*Continued from Page 76*)

however, is to a large extent a by-product and little attempt has been made to push this phase of the business.

The company is not equipped to deliver, although some small deliveries have been made to nearby points. The finished product is shipped by both railroad and truck, the method of shipping varying to a considerable extent. An average of about 40 per cent is shipped by truck, the balance going by railroad. Shipments by truck are made mostly to points in local territory, while railroad shipments are made along the Pennsylvania railroad, on which the plant is located. Sales are made to dealers, contractors, and railroads. Agricultural limestone is sold direct to farmers, county agents, and cooperative farm associations. Railroads in this section have begun to use crushed stone instead of gravel for ballast. In many cases crushed stone is preferred because, while the initial cost is slightly higher, it provides better drainage and does not pack as does gravel. It also lasts longer.

The management is under the direction of G. C. Adams, district superintendent for a group of the France Stone Company plants in this vicinity. Mr. Adams was formerly superintendent of this plant. Charles Gernet is the local superintendent.

A safety trophy inaugurated by the company for the plant making the lowest record in time-hours lost from accidents was awarded to this plant for the year 1928. A high mark of no accidents and no time lost for the year was established for the other plants to shoot at as well as a high record for this plant to live up to. On Saturday, June 15, the company gave a banquet to all the employes and their families at which this trophy was awarded.

Asphalt Association Will Hold Annual Meeting at West Baden

Elaborate entertainment features will be provided during the five-day annual meeting of the Asphalt Association to be opened October 2 at West Baden, Indiana. The attendance is expected to exceed that of 800 at the New Orleans meeting last year.

There will be humorous and serious subjects for discussion, the dominant one being the best and most economical methods for constructing secondary and tributary highways. It is said that only three per cent of our American farms are located along hard-surfaced roads, so one slogan of the meeting is "Get the farmers out of the mud."

The Association of Asphalt Paving Technologists will hold its annual meeting contemporaneously.

Manheim Mill of Alpha Cement Company Dedicates No-Accident Trophy

Accidents Numbered Thirty in 1925

By HARVEY A. BRASSARD

IN TESTIMONY to an outstanding spirit of cooperation in the prevention of accidents and to the wisdom of safety, the Portland Cement Association safety trophy for 1928 was unveiled July 6 at the Manheim plant of the Alpha Portland Cement Company.

"The trophy," as A. D. Boltz, representative of the Association at Parkersburg, West Virginia, pointed out in his address of presentation, "is a monument to achievement. It is unique in that it is erected in honor of the living, rather than the departed. Rather than a token of work laid down, it expresses acknowledgment of a work well begun."

More than 2,000 people were in attendance at the Manheim dedication. State dignitaries, headed by Governor W. G. Conley of West Virginia, industrial leaders, educators, jurists, clergy and military men of prominence made the ceremony outstanding in community significance and gave full testimony to the remarkable record of almost two years of perfect safety set up by the Manheim plant.

The program, interspersed with several numbers by the Terra Alta high-school band, was as follows:

Introductory Address—W. L. Matthes, superintendent of the Manheim mill.

G. S. Brown, President of the Alpha Portland Cement Company.

Address of Welcome—G. S. Brown, president, Alpha Portland Cement Company, and past president of the Portland Cement Association.

Formal Presentation of Trophy—A. D. Boltz, representative, Portland Cement Association, Parkersburg, West Virginia.

Unveiling of Trophy—Miss Cathryn Fretwell and Master Billy Leo Matthes, Jr.

Address of Acceptance—H. E. Lenker, plant engineer, Manheim mill.

Address of Dedication—Hon. Wm. G. Conley, governor of West Virginia.

Then followed a band concert, athletic contests, refreshment, presentation of prizes, and dinner.

Following the dinner, toasts, coupled with brief remarks, were responded to by Hon. Frank L. Bowman, representative, West Virginia; Hon. Howard S. Jarrett, state commissioner of labor; Judge A. G. Hughes, of Preston County Circuit Court; Dr. M. A. Proudfoot, plant physician; Hon. P. J. Crogan, dean of the county bar; Adjutant General C. C. Pierce, commandant, National Guard of West Virginia; Hon. James Henry Smith, member of state legislature.

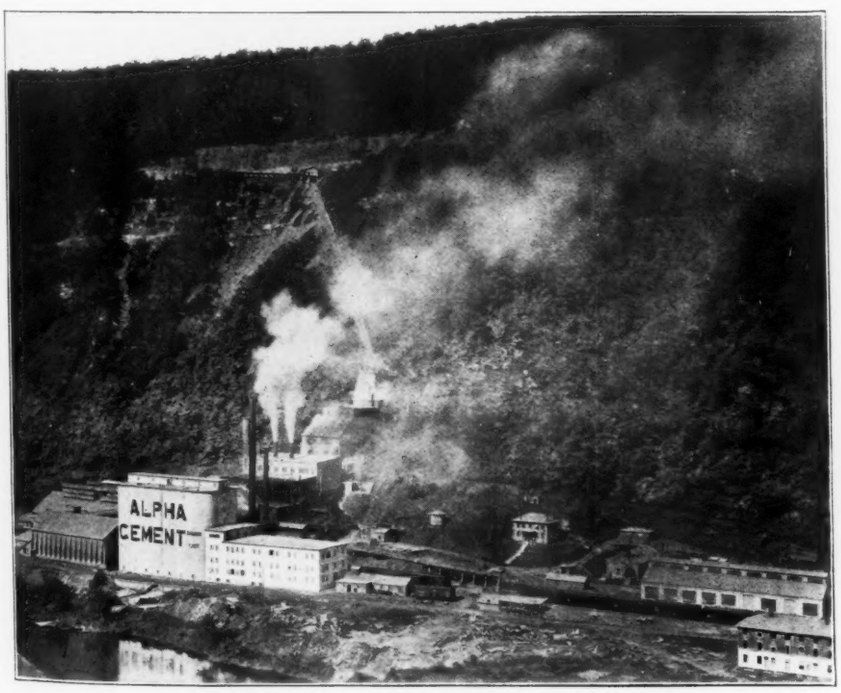
As master of ceremonies, W. L. Matthes reviewed the campaign for safety in the Manheim mill. The last lost-time accident occurred August 20, 1927. During 1924 the mill suffered 20 lost-time accidents amounting to 414 actual days lost. The totals mounted in 1925 to 30 lost-time accidents reported and 1,072 days lost. By intensive effort and the wholehearted cooperation of employes, these figures were reduced approximately 83 per cent the following year when but 5 lost-time accidents were recorded, amounting to 121 actual days lost. In 1927 lost-time accidents were cut to 3, whereas days lost remained at 121.

Gov. Conley Making the Dedicatory Address.

The 1928 campaign began with a rush of enthusiasm that bore up through the entire year and carried the mill to the front as one of the outstanding leaders in accident prevention of all industries.

"Your remarkable record bespeaks a wonderful spirit of cooperation, wherein every man of you is wholeheartedly interested in the well-being of the other," said Mr. Matthes. "You are to be congratulated. Your efforts have made possible this day."

Superintendent Matthes further paid respect to the encouragement and support given the safety movement by the management of the Al-



The Manheim Plant of the Alpha Portland Cement Company.

pha company, attributing much of the general enthusiasm to the example of the management.

G. S. Brown, president, Alpha Portland Cement Company, expressed sincere pride in the achievement of the Manheim mill. "There is always one thing which I reserve for myself," said President Brown, "one act which I do not delegate to another, one which I am never too busy to do and in which I take considerable pride. It is that of attending and taking part in the dedication of those safety trophies our mills are fortunate enough to receive."

Four mills of the Alpha company have been awarded Portland Cement Association safety trophies; the Ironton, Ohio; Bellevue, Michigan; and Manheim, West Virginia, mills in 1928 and the Martin's Creek, Pennsylvania, and Ironton mills in 1927.

Part of the Assemblage at Dedication Ceremony.

Mr. Boltz, in presenting the trophy on behalf of the association, expressed the hope that the monument would stand as a constant reminder and inspiration for the future and that the 1928 record of the Manheim mill be repeated not once but often during the years to come.

That it is better to dedicate a trophy to the living as a mark of

(Continued on Page 84)

W. L. Matthes, Superintendent, Manheim Plant.

Two Years' Operation Without Lost-Time Accidents Establishes a Record

Cowell Plant Is Reawarded Trophy

THE Cowell Portland Cement Company held its annual dance and house party at Cowell the evening of July 4 for its employees and guests. The special feature of the evening was the reawarding and unveiling of the safety trophy which was awarded to the Crowell Portland Cement Company a year ago for having gone through the year 1927 without a lost-time accident in its cement mill. It was reawarded for having gone through another year, 1928, without a lost-time accident.

A. P. Denton, district engineer of the Portland Cement Association, in reawarding the massive concrete monument, stated that the record of the Cowell Portland Cement Company, in having operated its entire plant from May 11, 1926, to the present time without a lost-time accident in any department, was a record unequalled in the annals of the cement industry. He congratulated the Cowell organization on the spirit of co-operation which must prevail in any manufacturing plant to attain such an outstanding record, and a record which is causing the eyes of the industrial world to look to Cowell, California.

E. D. Barnett, superintendent of the company, in accepting the trophy, said that the safety record was due to the individual effort of every man in the organization to work safely and to see that safe conditions were maintained in every department. It was also due, he said, to the helpful suggestions and inspirations given the company by the Portland Cement Association.

J. M. Harrington of the U. S. Bureau of Mines, Berkeley, presented the Cowell Portland Cement Company with the Joseph A. Holmes Safety Association's certificate of honor. He said that the meritorious record of the company in operating its cement plant from May 11, 1926, without a lost-time accident, and its quarry department from August 14, 1925, without a lost-time accident, was a record that a few years ago would have been thought impossible; but that by safe working and safe thinking the Cowell operations had drawn the attention of the United States government.

W. H. George, secretary and general manager of the company, responded on behalf of the company and its employees. He congratulated the U. S. Bureau of Mines on the safety work that it is carrying on, and said that the company's safety record was in a large part due to the assistance and help which the Bureau of Mines had given the Cowell company.

E. D. Barnett, Superintendent, Cowell Portland Cement Company.

The Cowell school children entertained by singing "The Star Spangled Banner" at the opening of the unveiling exercises and "America" toward the close of the evening's program.

Explosives Consumed

During May, 1929, according to a bulletin issued by the U. S. Bureau of Mines, the quarrying and non-metallic mining activities of the country consumed 14,589 kegs of black blasting powder, 7,629,870 pounds of high explosives other than permissible, and 42,630 pounds of permissible explosives. For the month of January to May inclusive, these respective consumptions were 77,213 kegs, 30,438,725 pounds, and 156,390 pounds.

More than 100,000 tons of limestone was displaced in the Mohawk Valley Limestone Products Company quarry in Jordanville, New York, recently when fifteen tons of dynamite was exploded. The shot was the largest ever fired by the company and the quantity of stone removed exceeded all previous records.

Canadian Cement Plant Earns Trophy Award for No-Accident Record

Prominent in Safety Work for Years

IN RECOGNITION of its remarkable work in accident prevention the Exshaw plant of the Canada Cement Company, Limited, was presented on July 15 with a huge cast-stone safety trophy by the Portland Cement Association. The Exshaw plant is one of 18 mills in the United States and Canada awarded the trophy in recognition of perfect no-accident records for 1928.

J. D. Johnson, Montreal, vice-president of the Canada Cement Company, and A. J. R. Curtis, assistant to the general manager, Portland Cement Association, were the principal speakers at the ceremony of dedication. W. D. Armstrong, superintendent, received the trophy on the part of the Exshaw plant.

"In presenting you with this trophy," said Mr. Curtis, "it is the hope of the association that you may repeat this splendid record often during years to come. The monument is unique in that it is erected in honor of the living, rather than the departed. It symbolizes achievement, rather than bereavement. It stands

J. D. Johnson, Superintendent.

in happy contrast with somber monuments in the silent cities of the dead. Rather than a token of work laid down, it expresses acknowledgment of a work well done."

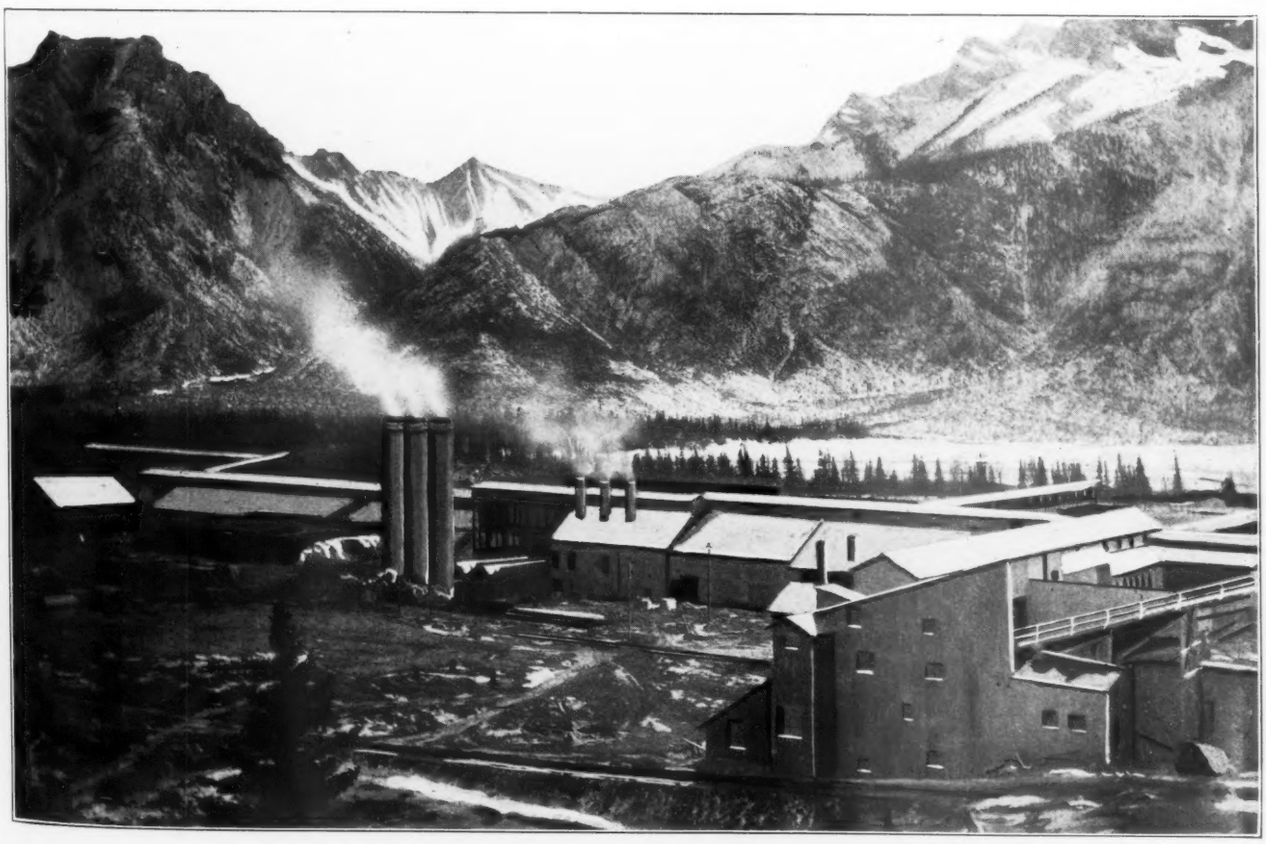
The huge monument is made up of two large blocks of hand-tooled cast stone, resembling granite. Sculptured on the face are the symbolical figures of Safety following Wisdom, who holds in outstretched hand the lamp of knowledge. Inscribed below are the words, "Safety Follows Wisdom."

The monument was designed by the Art Institute of Chicago.

"The need for safe thinking is perpetual," said Mr. Curtis. "No season, month, day or instant is free from the possibility of injury unless every man in the organization is constantly on the alert. Your record is a credit to yourselves and your community. It could come only as the result of a splendid spirit of co-operation and consideration for your fellow worker. Every man of you is to be congratulated."

The Exshaw plant has been prominent in accident-prevention work for a number of years, according to Mr. Curtis. In 1926 the plant had but 7 accidents while the average for the industry was 18. In 1927 the 7 was cut to 5 and in 1928 accidents were wiped out entirely; while the industry sustained an average of 6.6 accidents per plant.

Nova Scotia is reported to be the largest producer of gypsum in Canada. New Brunswick, Ontario, Manitoba and British Columbia follow in the order named.



Exshaw, Alberta, Plant of the Canada Cement Company, Limited.

Manheim Mill Trophy

(Continued from Page 82)

careful habits and safe practices, than a monument to the dead as a result of carelessness and neglect was the keynote of Governor Conley's address. In congratulating the Manheim organization, he expressed pride in the achievement of the West Virginia mill and the hope that other industrial establishments in the state would follow in the steps of the mill in seeking safety for their employes.

Others of prominence in attendance at the ceremony were: State Compensation Commissioner Lee Ott; Senator A. L. Helmick; H. R. Laughlin, superintendent, Baltimore & Ohio Railroad Company; J. G. Prichard, secretary, West Virginia Manufacturer's Association; A. W. Louther, district superintendent, Bethlehem Mine Corporation, West Virginia Division. President Brown, Vice-President F. G. McKelvy, General Superintendent N. D. Colburn, Safety Director W. W. Hamilton and all district managers of the Alpha company were in attendance.

U. S. Geological Survey Studying Oregon Minerals

The survey of the mineral deposits of southwestern Oregon, which has been started by J. T. Pardee of the United States Geological survey, is the first since 1916, when the operations of the Oregon Bureau of Mines and Geology ceased.

This survey is being made simultaneously in northeastern and southwestern Oregon, and was made possible through the appropriation by the state legislature of $30,000, which was matched by an equal amount by the federal government.

Washington Company To Mine Phosphate

The Washington Phosphate & Silver Company of Colfax, Washington, expects to be producing rock phosphate within a short time, according to M. J. Grady, secretary and treasurer. The deposits are located at Maxville, Montana, near the Northern Pacific Lines. The company is being incorporated under the laws of the state of Washington with the principal place of business at Colfax.

Buys Clay

The Marianna Lime Products Company has purchased vast areas of land near Cottondale, much of which contains valuable lime rock and clay deposits. The fertilizer and lime, asphalt fillers and other products.

Cement Mills' No-Accident Records Show Steady Improvement This Year

June Gain May Reach 20 Per Cent

THE JUNE No-Accident Campaign of the Portland Cement Association closed with an apparent gross total of 40 recordable accidents for the month. The corresponding gross total last year was about 50, so that current returns would indicate considerable improvement in the reduction of accident frequency during the annual June campaign. These figures represent the record of 159 mills which participated in the 1929 campaign as against 153 mills entered in the 1928 campaign.

Official figures for June, 1928, which include only the 136 mills from which the association received both man-hour and accident statistics, show 42 recordable accidents. It is estimated that corresponding figures for June, 1929, will show about 35 recordable accidents and it is probable that final June figures will show a reduction in accident frequency of between 10 and 20 per cent from those of last year. June, 1929, shows fewer accidents than any previous month since accident records have been kept by the association.

Revised frequency figures for the first half of 1929 as compared with the corresponding periods for the years 1925-1928 are as follows:

RECORDABLE ACCIDENTS

	*1929	1928	1927	1926	1925
January	59	63	133	197	249
February	51	76	108	183	232
March	46	91	140	198	252
April	73	101	152	171	236
May	75	82	110	174	234
June	40	42	59	204	92
Half-year total	344	455	702	1,127	1,295
Percentage of reduction from preceding year	24.3	30.4	37.7	12.9	.....

*These figures for 1929 are gross totals. Other years are net totals, including only figures for mills reporting both man-hour and accident statistics.

One hundred and thirty-six mills, or 85 per cent of those enrolled, completed June, 1929, without accident as compared with 124 mills which made a similar record one year ago. Twenty-three mills suffered one or more recordable accidents.

A comparison of records for 1928 and 1929 gives the following interesting information:

	June, 1929	June 1928
Mills enrolled	159	153
Gross recordable accidents	40	51
Gross lost-time accidents	36	50
Fatal accidents	4	1
Mills suffering 8 accidents	0	1
Mills suffering 6 accidents	0	1
Mills suffering 5 accidents	1	1
Mills suffering 4 accidents	2	0
Mills suffering 3 accidents	1	1
Mills suffering 2 accidents	2	4
Mills suffering 1 accident	17	21
Mills suffering no accidents	124	136

The disappointing feature of the campaign was the four fatal accidents, as against one each in June, 1927, and June, 1928. Of this number one was suffered by a mill whose record does not appear in the annual tabulation and another has been tabulated as fatal although the victim is still alive but death is momentarily expected. A detailed report covering these accidents will be issued by the association later.

June accidents classified by department are shown as follows:

Department	Number of Accidents June, 1929
Quarries	12
Mines	0
Clay pits	0
Crushing	3
Raw	2
Coal grinding	1
Burning	1
Finishing	1
Cement storage	0
Packing and shipping	4
Power	3
Shops	4
Yard	3
Other than above	1
Not given	5
Total	40

Expansion Program Is Planned By British Company

A recent communication from the Imperial Chemical Industries, Limited, London, states that its subsidiary, The Cement Section of Synthetic Ammonia and Nitrates, Limited, with headquarters at Billingham, England, plans to install a kiln at the Casebourne Works to produce 70,000 tons of cement per year. It also intends to erect a plant of one kiln to produce 80,000 tons of dry-process cement per year, as well as large quantities of sulphuric acid. The chief engineer of The Cement Section, T. J. Jackson, will operate under the direction of Captain G. M. Wilson, chief engineer of the subsidiary company.

Manganese Steel Forge Appoints Mexican Representative

The Manganese Steel Forge Company has appointed Wells, Fargo and Company Express S. A., Apartado Postal 361, Mexico, D. F., as sales representatives in Mexico for Rol-Man screens and other rolled and forged manganese-steel products manufactured by the company.

NON-METALLIC TRAFFIC PROBLEMS

Conducted by M. S. Allison

The O'Fallon Case

The developments in the St. Louis & O'Fallon Railway Company case have been of national interest because of the principle involved and its possible effect on the carriers and shipping public throughout the country.

In 1913 Congress directed the Interstate Commerce Commission to make a valuation of the physical property of the railroads and this work has been going on since that time, through the period of pre-war prices, the peak and the present, when there has been a great fluctuation of costs. The commission completed its appraisal of the St. Louis & O'Fallon Railway property and, based on the Transportation Act of 1920, section 15-A and such appraisal, entered an order of February 15, 1927, which directed this railway to place in a reserve fund one-half its net income over 6 per cent. Being dissatisfied with the appraisal, this railway appealed to the lower courts, where the I. C. C. order was affirmed, and an appeal was then taken to the Supreme Court of the United States, where a decision was obtained May 20, 1929, annulling the order of the I. C. C.

The Supreme Court found that the commission had not followed the law in that it failed to give consideration to the elements of value recognized by the law of the land, among which was the present cost of construction or reproduction. This decision will undoubtedly result in increased railroad property values, which cannot even be estimated, but one thing to be borne in mind is that the commission's appraisal completed in 1927 included a period of peak costs, whereas the costs of to-day, while higher than pre-war costs, are lower than the peak costs, and in the final analysis the increase in values will not be as great as if the pre-war and present costs were to be considered alone.

The effect of this decision on the shipping public cannot be estimated. The law provides that the carriers are entitled to a fair return on their investments and, even if an increase in rates were one way to accomplish this, such increase would have to be very nominal only, as fixed charges will remain the same. The increase, if any, would only be to the extent necessary to take care of returns on the present-day valuation. There is no alarm at the present time regarding any general increase in rates, although there may be a tendency to prevent reductions.

Rate-Fixing Power Is Curtailed

Of great importance is the recent finding of the Illinois Supreme Court in matters affecting freight rates. In the Illinois Commerce Commission Dockets 19,169 and 19,258 there was involved the measure of the rates on coal from Illinois mines to Peoria, Illinois.

After the hearing the commission ordered the carriers to make reductions ranging from 6 to 22c per ton and the carriers appealed to the Circuit Court of Peoria County. This affirmed the decision of the commission and the carriers then appealed to the state supreme court, which reversed the lower court and instructed that the cases be sent back to the commission for further hearing.

In its decision the Illinois Supreme Court says:

"Comparison of existing charges made under similar conditions and of ton-mile earnings constitute proper evidence for consideration in determining what are reasonable rates. The qualifications that the charges were made and the ton-mile earnings gained under similar conditions is essential to the probative value and competency of such rate comparisons. The mere comparison of distances, rates and ton-mile earnings affords no basis for the fixing of rates in any case. Not only must similarity of distance be shown to justify the admission of rates for comparison, but also similarity of operating conditions, the construction of the railroads, their grades and curves, the size of the trains, the density of the traffic, the volume, competitive conditions and all other circumstances which may affect the rate, must be shown and given consideration."

The shipping public is not in a position to obtain authentic and up-to-date information which the court has said is necessary, so that, if these findings are permitted to stand, it will be next to impossible for a shipper to make a case before the commission and there is the possibility of the principle being adopted in other states.

Undoubtedly the shipping interests in this proceeding will apply to the court for permission to argue these points further and ask for further consideration and modification of the ruling.

Artificial Stone

In Docket No. 21,302, Ornamental Stone Company, vs. Southern Railway *et al*, the Interstate Commerce Commission has found unreasonable and unduly prejudiced the rates on artificial stone from Charlotte, North Carolina to destinations in South Carolina. The rates were found unreasonable to the extent that they exceeded an unpublished scale used by the Southern Railway from Richmond, Virginia, to South Carolina.

Proposed Freight Rates

Central Freight Association Territory. (East of Mississippi River, North of Ohio River, West of Buffalo and Pittsburgh).

Docket No. 20,627. To amend tariffs applying on lime, agricultural and fluxing, having no commercial value for chemical or building purposes, c. l., between points in C. F. A. territory, including prorating points in Illinois, and on the Mississippi River, by publishing the following certificate which is also to be embodied in bills of lading to be signed by the shipper: "In consideration of the reduced freight rate assessed by the carriers for transportation of the shipment, we hereby certify that this entire shipment consists of lime, agricultural or fluxing, and has no commercial value as a chemical or building lime.

. . . . . .

Shipper."

Docket No. 21,278: To amend present tariffs to read: "Plaster in cloth or multi-wall paper bags may be included in c. l. shipments of gypsum blocks or tile, provided the weight of the plaster shall not be applied toward making up the required minimum weight on gypsum blocks or tile."

Docket No. 21,901: To reduce the rating on cement compound, building or floor (including not to exceed 25 per cent of magnesium chloride, in barrels or in iron or steel drums), dry in packages and liquid in barrels or drums, c. l. from Buffalo, New York to C. F. A. territory.

Present basis: 5th class, minimum weight, 36,000 lb.

Proposed basis: 6th class, minimum weight, 50,000 lb.

Docket No. 22,097: To establish on cement (common, hydraulic, natural or portland), c. l., from all origin points in C. F. A. territory to points in Southwestern Freight Bureau territory, commodity rates on the basis of the scale in I. C. C. Docket 16,845 (144 I. C. C. 585). This revision to apply only in connection with traffic to destinations in Southwestern Freight Bureau territory, (Louisiana and Arkansas) to which this scale was employed in setting in rates on cement from producing points in the south. Present: As published in agency and individual lines' issues.

Note.—The following are representative of the scale proposed:

300 miles	17½c.
400 miles	20½c.
500 miles	22½c.
600 miles	25c.
700 miles	27½c.
800 miles	30c.
900 miles	32½c.
1,000 miles	35c.

Docket No. 22,186:

To establish on feldspar, c. l., minimum weight 50,000 lb. from Abingdon, Illinois, the following per-ton rates:

To—	Present Rate	Proposed Rate
Evansville, Ind.	$4.20	$3.30
Kokomo, Ind.	4.20	3.30
Noblesville, Ind.	4.20	3.30
Chelsea, Mich.	5.00	3.90
Flint, Mich.	5.30	4.10
Mt. Clemens, Mich.	5.50	4.20
McKees Rocks, Pa.	5.90	4.60
Newcastle, Pa.	5.50	4.30
Chester, W. Va.	6.20	4.80
Clarksburg, W. Va.	6.60	5.10
Parkersburg, W. Va.	5.60	4.30
Cambridge, Ohio	5.20	4.10
Chillicothe, Ohio	5.00	3.90
Cincinnati, Ohio	4.60	3.60
Columbus, Ohio	5.00	3.90
East Liverpool, Ohio	6.20	4.80
Sebring, Ohio	5.50	4.30
Steubenville, Ohio	5.20	4.80
Tiffin, Ohio	4.90	3.80
Wellsville, Ohio	6.20	4.80
Zanesville, Ohio	5.20	4.10

New England Freight Association Territory.

Docket No. 17,302:

Sand, run-of-bank, gravel, and screenings, minimum weight 90 per cent of marked capacity of car from Auburn, Massachusetts.

To	Sand	Present Rate. Gravel and Screenings	Proposed Rate. Sand, Gravel and Screenings
	Per Ton	Per Ton	Per Ton
Worcester	70c.	85c.	50c.
	Per Cwt.	Per Cwt.	Per Ton
Princeton	10½c.	10½c.	120c.

Reason: To meet motor truck competition.

Docket No. 17,304:

Feldspar and flint rock from Bates, Littlefield, Lockes Mills and South Paris, Maine, to Flemington, New York, and Jersey City, Maurer, Metuchen, Newark and Perth Amboy, New Jersey.

Present rate .....22½c.

Proposed rate .....21c.

Reason: To meet rates from Bowdoinham, Maine, etc.

Proposed Slag Scale

In a tentative report in I. C. C. Docket No. 21646 the Examiner recommends that the Commission find not unreasonable in the past the rates on slag from Reading, Hokendaqua, Bethlehem, and Swedeland, Pa., to Providence, Auburn, Esmond and Cranston, R. I., and Attleboro, Mass. He recommends, however, that the rates from Reading and Swedeland for the future be found unreasonable to the extent that they may exceed a distance scale in cents per net ton.

The proposed scale begins with a rate of $1.50 for distances over 100 miles, but not exceeding 125 miles. It progresses in 25 mile blocks to 200 miles, at which distance the scale would provide a rate of $1.85. It then progresses by 30 mile blocks to 350 miles, at which distance the rate proposed is $2.50.

The subject is yet to be passed upon by the I. C. C. and final decision rendered which may or may not agree with the tentative report.

Sand (Permutit or Zeolites)

The Permutit Company, New York, has filed formal complaint which has been assigned Docket No. 22369.

The complaint attacks rates on sand known as Permutit or Zeolites from Birmingham, N. J., to all points in all parts of the United States, on lines defendants, as unreasonable, discriminatory and prejudicial.

It is claimed that lower rates are maintained from points in Southern New Jersey and Philadelphia, Pa.

Freight Loading

Revenue Freight loading January 1 to June 15, 1929, was 23,432,168 cars, as compared with 22,470,714 cars in the corresponding period of 1928, or an increase of 961,454 cars. Some time ago the American Railway Association estimated that the year 1929 would show an increase of almost 1,000,000 cars over 1928, and from the results thus far it appears that this estimate will be correct.

Cement or Concrete Articles (Reinforced)

Generally speaking, Reinforced Concrete articles are rated in Central Freight Association Territory (East of the Mississippi River, North of the Ohio River and West of Buffalo, New York and Pittsburgh, Pa.) at 75 per cent of Sixth Class rate.

The carriers in such territory are taking steps so that wherever rates are lower than 75 per cent of Sixth Class rate that they be increased to that basis, effective August 1st.

Some of the articles to which this adjustment is proposed are as follows:

Blocks, Cement, Silo.

Blocks, or Staves, Concrete, Silo.

Posts, Fence or Mail Box, Cement or Concrete.

Slabs, Cement, Building or Roofing.

Slabs, Cement, Silo.

Slabs, Concrete, Crossing.

Sand to Owen Sound, Ontario

In I. & S. Docket No. 3318, the Interstate Commerce Commission has suspended tariff schedules proposing increase in rate on sand from Millington, Oregon, Ottawa, Sheridan, Utica and Wedron to Owen Sound, Ontario. The present rate is $5.04 and the suspended rate $5.40 per ton.

Machinery Discussed Non-Technically in New Book

When we opened "Men and Machines," a new book published by the Macmillan Company, we experienced a confusion of ideas concerning its real theme. It is not a book dealing with mechanical details but, rather, an intensely interesting study of the influence that invention, science and machinery have wrought in the sociologic and economic affairs of man. So our review of this book by Stuart Chase is the suggestion that any of our readers would no doubt derive as much real enlightenment on many matters of history and general progress in the world from this book as did we.

Hardening Lime

In the manufacture of objects of artificial stone by mixing an aqueous solution of $Ca(OH)_2$ with fillers, etc., shaping, and hardening with CO_2, the hardening is accelerated by adding to the initial mass substances, such as sugar, which combine with $Ca(OH)_2$ and increase its solubility in water but are set free again by CO_2. The objects may be heated to 60-80 degrees after hardening.

INSURANCE IN THE NON-METALLIC INDUSTRIES

Conducted by Dwight Ingram

The Owner, Not the Building, Is Insured

A man once bought a building in a great hurry. The seller told him the property was fully insured, so he thought he could wait a day or two until he had more time to straighten out the policies. Overnight the building was destroyed by fire. The seller, in whose name the insurance stood, could not collect because he was no longer the owner, and the buyer had no insurance. Possibly in this case the insurance companies were generous enough to pay the loss anyway, but, if so, the payment was pure charity and was not called for legally.

The common expression, "I have insured my building," has led to a great deal of confusion when property changes hands. People buy buildings, automobiles, boats or machinery and take over the old insurance policies without a thought. Because the property is correctly described in the policies they assume the insurance is perfectly good under all conditions.

The first important feature about an insurance policy is to realize that the protection does not automatically follow any owner. If an automobile changes hands, the insurance does not do likewise unless a special arrangement is made. A policy insures a certain individual's interest, not the property itself, and it is void unless the individual is named and his interest correctly stated. It is vital, when you are going to buy a piece of property, that you make preliminary plans for coverage before the title passes in order to keep the protection in force.

The title to ownership of property may be clouded in many ways. Mortgages of real estate, chattel mortgages, contracts of purchase, and erection of buildings on leased ground, all put limitations of some sort on the rights of the title holder. The standard fire insurance policy states that the entire insurance is void "if the interest of the insured be other than unconditional and sole ownership," and this provision can be waived only by putting an endorsement on the policy outlining the full facts.

Chattel Mortgages

The chattel mortgage figures in an increasingly large number of insurance loss complications because machinery of all sorts is more and more being purchased on contract with payments extending over many months. The manufacturers of such machinery usually retain a mortgage on the property until the final payment has been made. In most cases, this custom is sound economics because the machinery partly pays for itself through its current operation. The practice involves some danger to insurance policies, however. If you hold blanket insurance on all your property and one machine is mortgaged in favor of its manufacturer, your entire protection is invalidated. The producer buying machinery on partial payments should at once notify his broker of the situation. Then he can secure a separate policy on the mortgaged machine, definitely excluding it from his general insurance, or he can have permission for the existence of the mortgage endorsed on all his policies. This action is much more than an idle technicality, because underwriters are prejudiced against granting protection to property on which there is a chattel mortgage. This prejudice comes from the fact that chattel mortgages often represent the last hope of a failing concern to raise money after the banks have stopped credit, and sometimes the existence of the mortgage indicates a moral hazard, or willingness to "sell out to the insurance companies." Companies are rather strict in requiring information about such mortgages from their insureds, and the property owner will save himself a deal of trouble in case of loss by always keeping his broker informed if he makes or changes a mortgage.

A mortgage on real estate does not lead to the same results as a chattel mortgage, because a real estate mortgage seldom implies financial instability or moral hazard. Your insurance agent should be notified about a real-estate mortgage mainly so that both owner and mortgagee shall collect their proper interests in case of loss.

Buildings on Leased Ground

Along in the middle of the fine print on the inside page of an insurance policy—which very few people ever read—is a line which says that the insurance is void if the building stands on leased ground. Now it is not uncommon for a firm to procure a ground lease on desirable land for a term of years and erect suitable buildings thereon. The buildings are paid for and owned by the lessee, even though they may become a part of the real estate and revert to the lessor at the expiration of the lease. In this case the lessor has no immediate interest in carrying insurance and yet the lessee is not an "unconditional and sole owner." The lessee of the ground will, however, want to insure the buildings he has put up, and he can do so if he takes care to have an endorsement put on his policies stating that the insurance company will waive the policy prohibition against buildings on leased land.

The final complication of property titles is the contract of purchase. This device is more common in residence property, where an agreement to buy is often made with a very small down payment. But even in transactions involving business property a preliminary contract usually precedes the transfer of title and binds the agreement for the time necessary to iron out legal details. As soon as a man has made a contract to sell his property he is no longer the unconditional owner, and his protection is forfeited. When a sale is contemplated the insurance companies should be notified before the contract is signed, and the policies should be endorsed to show the interest of the new buyer under contract. In this way both buyer and seller will have their property fully protected according to their respective interests.

It is worth noting that the above principles apply to insurance on other classes of property than buildings. Mortgages and changes of ownership are very common in the case of automobiles, and the rules are virtually the same in the cases of ships, machines and other personal property. The "fine print" of policies was not invented by malicious insurance companies to help themselves in avoiding payments of straightforward claims. It is the painstaking findings of years of test cases in court, and represents the rules that are considered best for the general public. Companies will go a long way to help a policy holder who has violated one of these conditions through ignorance with no intent to defraud. But you should always remember that an insurance policy is not a blanket promise to pay under all conditions; it is a personal contract, subject to the general laws of contracts, and the insured can count on getting out of it only what the policy calls for.

Liability of Common Carrier For Loss of Shipped Merchandise

It is well established law that a common carrier is practically an insurer of the safe arrival of goods, which it accepts for transportation. In fact, the carrier is liable for all loss resulting from its own negligence, and against all other loss or damages, except such as may be caused by the act of God, a public enemy of the United States, the act of the shipper, or the inherent nature of the goods.

Moreover, although the damage is due to one of these causes, the carrier still is liable for any damage which may result by its failure to exercise reasonable care to protect the shipment from such loss or damage.

For instance, in St. Louis-San Francisco Ry. Co. v. Ozark White Lime Co., 9 S. W. (2d) 17, it was disclosed that a seller shipped lime by a common carrier which placed it on the side track some three or four feet lower than its main line tracks. For four or five days rains were falling, and a flood was rising gradually, but continuously. At the end of this period an adjacent river flooded the cars and destroyed the lime.

The carrier attempted to avoid liability on the contention that the damage resulted from "an act of God." However, it is interesting to observe that the Court held the carrier liable, stating the following important law:

"The act of God which excuses must be not only the proximate cause but the sole cause. And where the act of God is the cause of the injury, but the act of the party so mingles with it as to be also an efficient and cooperating cause, the party will be still responsible. . . . . There was no sudden and unexpected rise in the Grand river."

Contractor Entitled to Payment on Breached Contract

While it is true that a contractor is not entitled to payment for work performed before he wilfully breaches the contract, yet if such breach is justifiable or caused by any act on the part of the owner, the contractor is entitled to breach the same and recover full payment.

For example, in Arendsen v. Edw. D. Boyle & Co., 119 So. 282, it was disclosed that a contractor and a company entered into a verbal contract whereby the latter agreed to pay the contractor a specified amount for each load of rock hauled, without indicating when such payments were to be made.

After the contractor had earned approximately $200, and the company had paid him only $50, the contractor demanded full payment, which the company refused.

The contractor then abandoned the job and sued to recover the $150 balance due for the work performed.

The company attempted to avoid payment on the old established rule that a contractor who abandons a job, or breaches a contract, is not entitled to payment for the work performed before the act of abandonment. However, the Court held the contractor entitled to recover full payment, saying:

"The contract was verbal and not at all specific. There was no stipulation as to quantity of material to be hauled nor as to payment for work done. I think it fair to consider that payments for the hauling must be paid as the work progressed. Plaintiff (contractor) hauled 3,750 feet of curbing and was only paid $50, less than one-fourth the amount earned under the contract, and he refused to proceed further with it unless he was paid weekly, or as the work progressed. Repeated demands for such payment were ignored by defendant. This refusal justified the plaintiff (contractor) in abandoning the contract and he is entitled to pay for such work."

New Corporations

Coolspring Bluestone Co., c/o E. J. McDaniel, attorney, Blackstone Bldg., Uniontown, Pa.; $25,000.

Young Sand & Gravel Co., 2720 E. 55th St., Cleveland, O.; $5000.

Louisiana Sand & Gravel Co., Inc., Chas. D. Hightower, 618 Maison Blanche Bldg., New Orleans, La.; $50,000.

Crab Orchard Stone Co., Inc., Nashville, Tenn.; 500 shares, $100 each; 750 shares n.p.v. John Oman, Jr., Sirton Oman, John Oman III.

Western Quarry Co., John J. Stark, secretary, 1422 Walnut St., Des Moines, Ia.; $10,000. M. O. Weaver, president-treasurer, Iowa Falls, Iowa.

Diatomite, Inc., J. B. Sutton, 501 Wallace S. Bldg., Tampa, Fla.; $50,000. R. W. Shackleford, G. L. Reeves, J. B. Sutton.

New Hyde Park Sand & Gravel Co., c/o Canner & Jacobson, Jamaica, N. Y.; $20,000.

Denton Sand & Gravel Co., Denton, Tex.; $5000. W. M. Jagoe, W. D. Hollers, Hugh Keel.

S. I. Sand & Gravel Co., c/o E. Gettinger, 1501 Broadway, New York City; $20,000.

Montana Phosphate Co., Central Bldg., Seattle, Wash.; $50,000. H. C. Lake, president, Portland, Ore.; Maj. H. W. Boetzkes, secretary-treasurer, Seattle.

Maitland Gypsum Co., Boston, Mass.; $300,000. Daniel W. Donahue, Cambridge; Henry W. Sprague, Wakefield.

Gypsum Products Sales Corp., Boston, Mass.; 5000 shares n.p.v. Richard B. Constantine, Boston; Austin M. Pinkham, Winchester.

Powell Lime & Cement Co., Memphis, Tenn.; $25,000. J. L. Powell, president; R. L. Pemberton, general manager.

Standard Lime Co., Birmingham, Ala., $50,000. Harry Burgess, president; Joseph F. Donohoo, vice-president; J. C. Whitlock, secretary.

Venango Stone Co., Inc., Jersey City, N. J.; $125,000. Irwin Rubenstein, West New York, N. J. Limestone products.

Central Rock Co., Lexington, Ky.; $60,000. T. Ward Havely, Bruce Isaacs, J. P. Johnston.

Central Sand & Gravel Co., Inc., Noblesville, Ind.; 1000 shares n.p.v. Sterling R. Standerford, Robert M. House, Floyd G. Christian, Glen J. Gifford.

Kershaw Slag Co., 610 Woodward Bldg., Birmingham, Ala.; 1000 shares common. C. G. Kershaw, president; T. M. Porterfield, secretary-treasurer.

Black Diamond Graphite Corp., Harold D. Collart, 1310 W. 102nd St., Cleveland, O.; 3000 shares n.p.v.

Engineering Index for 1928

All plant operators are doubtless familiar with what is known as *The Engineering Index*, an annual publication of The American Society of Mechanical Engineers. This encyclopedia and index covering all branches of engineering has been used as a guide for 45 years. The 1928 issue, in two volumes, is being distributed. It classifies articles that were published during last year in 1,700 periodicals. The price, $125, may appear prohibitive, but its possession will save its price many times to any company whose engineering or technical staff has occasion to consult references.

Ohio Silica Sand Plant Joins Consolidation

The Industrial Silica Corporation of Youngstown, Ohio, has absorbed the Silica Products Company, which maintains a plant at Bedford, Ohio. This is the fifteenth silica plant in the Middle West to be consolidated with the Portage Silica Company as the nucleus. E. E. Klooz is president and general manager of the corporation.

PIT AND QUARRY FOREIGN DIGEST

Conducted by C. P. Harris, Ph.D.

Curing Aluminous Cement

Aluminous cement surfaces have a decided tendency to sand when cured in the usual manner. This was thought to be due to the fact that, while the same methods are used for curing both kinds of cement, they have very different properties. Three series of tests were run to determine the effect the condition of the surface

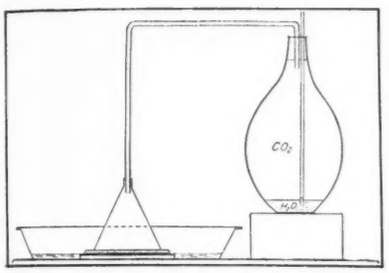


Fig. 1.

during curing has upon the sanding phenomenon. In the first series the surface was kept completely dry. Standard pats of both aluminous and portland cements were placed upon blotting paper, the rims of the test pieces being made air-tight with vaseline. The aluminous cement exhibited a greater sanding effect than the portland cement. This result is in accord with the idea that aluminous cement requires a greater amount of water during setting. In the second series of tests the test pieces were subjected to a steady stream of pure water on the surface for 24 hr. during setting. This test resulted in little or no sanding off, whereas usually the amount is from 0.2 to 0.6 mm. After several days under water a complete and thorough hardening of the test piece always occurred. The third test comprised a comparison of aluminous cement set with pure water and with water saturated with carbon dioxide. The addition of carbon dioxide effected a slight deterioration of the properties of the cement as compared with those of the cement which was set with pure water. On treating a thin cake of cement with air containing a large amount of carbon dioxide it was found that the surface became completely carbonated and would no longer dye with *crystal ponceau*, whereas the interior became the usual light red. Fig. 1 shows the apparatus employed to saturate the surface of the cake with CO_2.—A. F. Roscher Lund. (*Zement*, June 6, 1929.)

Cement Manufacture

A vertical kiln is heated by four burners at the bottom. The raw material in the form of powder or slurry is projected from jets placed below the burners through and upward with the flames. The velocity of the hot gases is adjusted so that the spray is kept suspended until drying and clinkering are complete. The consequent increase in density causes the particles to fall back through the flames and collect in the bottom of the kiln. The waste heat of the gases and clinker is utilized by boilers or for preheating the air. The flame temperature and gas velocity are adjusted so that the material is suspended sufficiently long to attain the clinkering temperature of 1,400 deg. C. The clinker produced is already in a fine state of division and facilitates subsequent grinding.—A. C. Davis (British Patent No. 307,763, B. C. A.).

Graphic Slip Determinations

A graphic method for determining all feasible mixtures of more than two raw materials for the production of hydraulic mortars has been devised. It is based on the following: The hydraulic modulus is recognized as the most important factor concerning a cement and the least variable. For a fixed hydraulic modulus and variable silicate modulus the curves for the three raw materials are drawn. These curves, with constant hydraulic modulus, show that the mixing number be-

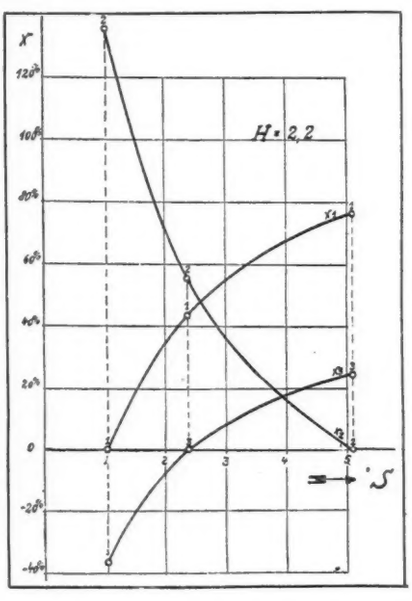


Fig. 2.

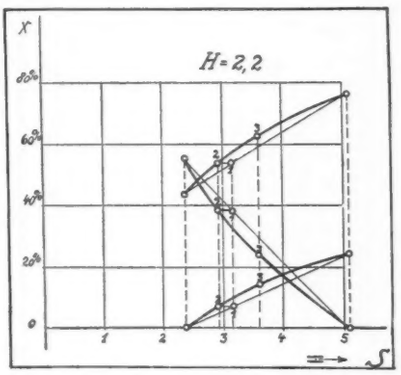


Fig. 3.

comes zero. It is necessary only to know the mixing numbers and the silicate modulus of the following mixtures:

$$\text{Material } 1 + 2x_3 = 0$$
$$1 + 3x_2 = 0$$
$$1 + 3x_1 = 0$$
$$x1 + x_2 + x_3 = 1$$

If the corresponding hydraulic moduli agree with the following values tested, sufficient data will be at hand. The three points on the diagram (Fig. 2) S=1.03, S=2.35 and S=5.1, are made the basis of a new curve, which is corrected with the result in view that the sum of the three raw materials, x_1, x_2, and x_3, will be 1 and the result will be sufficiently accurate for all practical purposes. The percentage of the three constituents may be read off for any feasible silicate modulus, as shown in Fig. 3. The lines 1, 2, 3 show the possible compositions for the indicated silicate moduli.—F. W. Meier (*Zement*, May 30, 1929).

Efflorescence of Mortars

The efflorescence is due to prolonged variations in moisture content, the resulting moistening and evaporation dissolving soluble salts in the mortar and depositing them on the surface. This effect may be avoided either by the use of waterproof films, where the mortar is in contact with the masonry, or by the use of certain cements. The soluble salts must be diminished by the use of pure cements and fine sand. —Anon. (Un. techn. du Batiment, etc. and *Le Ciment*, May, 1929).

Asbestos and X-Rays

Four varieties of asbestos—chrysotile, amphibole, crocidolite and anrosite—were examined by X-rays both before and after treatment. This included heating the fresh asbestos to 900 deg. C. and also with concentrated

hydrochloric acid. In the acid treatment chrysotile lost more than 50 per cent in weight, and the X-rays showed a complete disappearance of fibrous structure. The other varieties showed less loss in weight and retained part of their fibrous structure. On heat treatment the chrysotiles exhibited a high loss in weight, but their fibrous structure was not so badly affected in some cases as that of certain amphiboles. The variety of asbestos could be distinguished by the behavior.—Clark & Van Orden (*Kantschuk*, 1929, 5, 28-35).

Asbestos-Cement Sheets

Only pliable chrysotile asbestos is suitable for this use, and the chemical composition must be known, as good fibers with too high a magnesia content are unsuitable. The cement used should preferably be high in silica, rather than lime. The water used is important; it should not be more than moderately hard and should contain only a small amount of carbon dioxide. The pressure on the sieves in the manufacture of the plates should be 30 to 45 pounds. The product may be colored by mineral pigments. The hardening is done in a special chamber and takes 12 to 14 hr. at a carefully regulated temperature.—E. Lechner (*Zement*, June 13, 1929).

Cement and Phosphoric Acid

Cement and phosphoric acid are formed by treating calcium phosphate with sulphuric acid to obtain phosphoric acid and gypsum, working up the gypsum in the known manner with materials containing carbon and alumina to yield cement and sulphuric acid. This is used for the treatment of fresh quantities of phosphate.—I. G. Farbenindustries A. G. (British Patent No. 309,604).

Cement and Sulphuric Acid

A process for the joint production of portland cement and sulphuric acid consists of introducing a mixture of sand, clay and calcium sulphate into a kiln in the form of a dry powder. The powder is blown into a combustion chamber through nozzles suitably situated with reference to the fuel burners. Combined inlets for the powder and pulverized fuel may be in the form of two or more concentric nozzles, or separate nozzles may be so arranged that the two jets impinge in the center of the chamber. The hot gases laden with cement dust and containing sulphur dioxide are passed into a second chamber in the form of a vortex separator, or the combustion chamber may constitute a vortex separator. The gases are further purified by a second vortex separator or by an electrical separator.—G. J. Harris & Imperial Chemical Industries, Ltd. (British Patent No. 309,-661).

Portland Cement

Portland cement containing from 5 to 15 per cent magnesia is prepared by heating, after sintering, raw materials rich in magnesia, such as blast-furnace slag, to a temperature exceeding 1,450 degrees C. for at least 20 minutes. The free lime displaces magnesia in combustion.—Balthasar, Krause, Zingl, Derflinger & Ortis (Austria) (British Patent No. 309,-069).

New Patents on Alumina

Alumina is extracted from clay or bauxite with acid, the level of which is maintained above the material treated, and the flow of acid is regulated in such a way as to reach a temperature above 105 deg. in the reaction zone, increasing from the top to the bottom of the charge.

In the production of Al_2O_3 from bauxite, electrothermally by the addition of a magnetic metal or compound, the latter is added at the end of the charging period, followed by the addition of other reducing means such as C to obtain an even distribution throughout the mass. The Fe may be added in the form of aluminous substances obtained by dissolving primary aluminous substances in HCl, separating the solution, evaporating, and decomposing the salts by heat.

In the electrothermal preparation of Al_2O_3 from bauxite, using reducing agents such as C, the initial charge contains less C than is necessary for the reduction of the impurities, the proportion is afterwards increased to the theoretical amount and finally an excess is introduced. Towards the end of the charge, or after it, a heavy metal, preferably Fe or compounds thereof, is added with the C.

$Al(OH)_3$ containing comparatively little SiO_2 is prepared from slag or like material containing compounds of Al and Ca by treating the material with an alkali-carbonate solution containing an amount of alkali hydroxide slightly in excess of that required to dissolve the Al_2O_3, and precipitating $Al(OH)_3$ from the solution. The extracting solution may contain also some $Al(ONa)_3$.—(French Patents Nos. 641,623 and 641,692; Swiss Patent No. 127,248).

Weathering Test of Cement

The change of the properties of portland cement (A) and of blast-furnace cement (B) due to weathering has been measured for six months, the measurements mentioned below being made sixteen times within that period. The ignition loss increased with weathering from 2.14 to 7.98 per cent in A, from 1.16 to 6.5 per cent in B. The tensile strength of A changed from 30.1 kg./cc to 32.3 kg./cc in 28 days, of B from 34.6 kg./cc to 20.8 kg./cc. The resistance to pressure showed almost no decrease in A, while in B the decrease was remarkable, *i. e.*, from 238 kg./cc to 41 kg./cc. While the setting time in B is sometimes markedly lengthened, no such phenomenon is observed in A. B is inferior to A in many respects, especailly in strength.—Koji Ohazama, *et al.* Reconstruction Bureau (Tokyo). (Bull. Reconstruction Bureau 10, 108-9 (1927) C. A.

Recent Patents

The following patents of interest to readers of this journal recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trade-mark attorney, Continental Trust Building, Washington, D. C., at the rate of 20 c. each. State number of patent and name of inventor when ordering.

1,717,476. Ditch-digging machine. Charles T. Topping, Dayton, Ohio.

1,717,498. Vibrating screen. Emil Deister, Fort Wayne, Indiana.

1,717,523. Tripping mechanism for scoops. Guy B. Scott, Frisco, Pennsylvania.

1,717,549. Grab bucket. Edgar E. Brosius, Pittsburgh, Pennsylvania.

1,717,555. Sand separating and blending machine. Frank S. Haefner and Lewis F. Zweibel, Wilkes-Barre, Pennsylvania.

1,717,591. Fluid-actuated engine. Clarence B. Weston, Erie, Pennsylvania, assignor to Bucyrus-Erie Company, South Milwaukee, Wisconsin.

1,717,597. Excavating method and apparatus. Oliver O. App, New York, New York, assignor to App Tunneling Machine Company.

1,717,598. Steering apparatus for motor-driven vehicles. Edwin J. Armstrong, Erie, Pennsylvania, assignor to Bucyrus-Erie Company, South Milwaukee, Wisconsin.

1,717,599. Fluid-actuated engine. Edwin J. Armstrong, Erie, Pennsylvania, assignor to Bucyrus-Erie Company, South Milwaukee, Wisconsin.

1,717,757. Steering control for endless-traction cranes. Harold E. Brey, Milwaukee, Wisconsin, assignor to Koehring Company, same place.

INTIMATE NEWS OF MEN AND PLANTS

American Aggregates Adds To Indianapolis Facilities

The American Aggregates Corporation has leased a portion of the yards belonging to the Casady Fuel & Supply Company at Tenth Street and the Belt Railway, Indianapolis. Material will be shipped in from the main plant on Raymond Street for city distribution.

A temporary arrangement will be made at the new yard for the remainder of the summer. In the fall bins and elevators capable of handling fifty cars a day will be installed. It is also reported that a new plant for truck distribution only is being planned. This will be located on Raymond Street, adjacent to the old Granite Sand & Gravel Company plant which was recently purchased by the American Aggregates Corporation.

Southwest Stone Company Buys Two Plants

The Southwest Stone Company, 404 Santa Fe Building, Dallas, Texas, on July 1 purchased the assets of the Texas Trap Rock Corporation of San Antonio, Texas, and the Stringtown Crushed Rock Company of McAlester, Oklahoma. All accounts payable have been assumed. The management and ownership will continue as before with W. F. Wise, president, and H. C. Perry, secretary-treasurer.

H. D. Conkey & Company Plan Expansion

H. D. Conkey & Company, sand and gravel producers with offices at Mendota, Illinois, recently purchased a considerable acreage adjacent to the present plant at Moronts. This property is located on both the New York Central and Chicago, Milwaukee & St. Paul railroads. A new and modern plant with a capacity of about fifty cars daily is planned for next year.

Mexican Cement Company Builds Lime Plant

A construction program is under way by the Compania de Cemento Portland Landa, S. A., at Puebla, State of Puebla, Mexico, with the expectation that operations will begin about the close of this year. W. B. Williams of Woodland, Michigan, formerly engineer for the La Tolteca plant of Campania de Cemento Portland, S. A., State of Hidalgo, is chief engineer. Other officials of the Landa company are: F. J. Miller, president; J. L. Crosthwait, manager; and Alton J. Blank, general superintendent and supervising chemist.

The plant will contain an 8-ft.-by-125-ft. kiln, with a cooler, a dryer, and several tube mills. A new limestone quarry is to be opened for the manufacture of lump and hydrated lime.

Commercial Sizes of Indiana Crushed Limestone

In explaining the several commercial sizes or grades of crushed stone which his company makes, E. T. Milligan, secretary of the Muncie Stone & Lime Company, said recently:

"Our business is quarrying and crushing limestone. We manufacture six different sizes of stone for many uses. One large-size stone passing a 4½-in. screen and retained on a 2¼-in. screen is used for street and road construction in the base and, in some cases, in both the base and the second course. The 2¼-in. to 1¼-in. size is also used in road construction as well as for concrete aggregate. Our 1¼-in. to ¾-in. stone is used for concrete aggregate and road and street repair, ¾-in. to ¼-in. for top dressing on roads and automobile drives. Our ½-in. to dust, or screenings, is used in road and street construction as well as numerous other places. It is used quite a little for cement work. It makes a fine aggregate for concrete work, as it contains about the proper mix when the cement is added in the proper proportion; nothing else is needed for a good job of concrete.

"We are just beginning to make agricultural limestone, a fine material to be used by the farmers for their sour and acid land, and some are getting very fine results from its use."

Pennsylvania Company Changes Name

The Kittaning Limestone Company, Kittaning, Pennsylvania, has changed its name to the Kittaning Cement & Limestone Company. The construction of a dock 2,500 ft. long and extension of the present conveying, distributing and storage facilities, involving an expenditure of more than $600,000, are planned.

New Phosphate Rock Firm Acquires Montana Deposits

According to H. W. Boetzkes, its secretary-treasurer, the Montana Phosphate Company, a new Seattle concern, has acquired a phosphate deposit near Garrison, Montana, known as the Anderson property. The deposit is a hard rock, black to gray-blue in color, in beds from four to seven feet thick and averaging better than 74 per cent B. P. L. About 800,000 tons of this rock are blocked out with an estimate of probably 1,500,000 tons available without the necessity of shaft sinking. The quarry is about seven miles from the Northern Pacific and Chicago, Milwaukee and St. Paul railways.

New Michigan Gravel Plant Nears Completion

West Side Gravel Company is installing new equipment in its plant at Level Park, near Battle Creek, Michigan. Wells are being driven for the water supply and the plant is expected to be in operation by July 1. Ross Chapin of Battle Creek and E. C. Leach of Kalamazoo are members of the company.

Virginia Plant Nears Completion

The Virginia Greenstone Corporation of Lynchburg, Virginia, is installing a mill for working stone into thin slabs for building tanks, sinks, laundry trays, fire brick, and similar uses, according to C. G. Loving, president. Preparations are also being made to grind the waste stone for paints and roofing material.

Marquette Lets Contract

The Marquette Cement Manufacturing Company has let a contract to the Gamble Construction Company of St. Louis, Missouri, for the construction of a cement-storage and distributing plant which will cost about $90,000 with equipment. L. E. Ritter, 140 South Dearborn Street, Chicago, is architect.

Minnesota Mining Expands

Minnesota Mining and Manufacturing Company of Forest and Fauquier Sts., St. Paul, Minnesota, will take bids on a two-story addition, to cost $140,000 with equipment. Toltz, King & Day, Inc., is the architect.

NEWS OF EQUIPMENT MANUFACTURERS

A New Control Pyrometer

The Republic Flow Meters Company, maker of all types of meters, gauges, pyrometers and recorders, in its new Catalog No. 200 describes the electric-control pyrometer, Model 133, which is designed to be used on any type of valve mechanism and motor, solenoid, pneumatic, electric or oil-fired furnaces.

The mechanism is all contained within a wall-type case. All metallic contacts, auxiliary relays and control panels have been eliminated. A gas-filled mercury contactor switch and Republic millivolt meter are used.

Superheaters Described

The Superheater Company is distributing a pamphlet describing Elesco multiple-loop, single-pass superheaters for stationary boilers. The various types include the convection and interdeck types for horizontal boilers; the intertube type in various arrangements for semi-vertical boilers; the standard types for vertical, waste-heat, and horizontal-return tubular boilers; and the radiant type for furnaces in which considerable dust is likely to lodge on the heating surfaces.

Van Dorn Appointments

The Van Dorn Electric Tool Company announces the appointment of R. W. Proctor as general sales manager. Mr. Proctor was formerly with Black & Decker. J. M. Beggs, formerly in the sales department, has been appointed advertising manager.

Consolidated Weigh Larry For Batching Materials

The Consolidated Concrete Machinery Company, in its monthly magazine "Consolidated Contact," describes a new weigh larry for conveying accurately-measured quantities of raw material from storage piles or bins to one or more mixers. With this larry a producer of sand and gravel can serve a number of central-mixing plants at the same time or fill trucks with varying proportions of aggregate as desired.

The hopper is of heavy copper steel, the frame of channels and angles, and the entire unit is mounted on two trucks with Hyatt roller bearings operating on overhead rails. The scale is a combination dial scale and beam scale, the beam being set for the tare weight of the hopper. A duplex valve on the hopper is operated by a hand lever.

Riddell Company Issues New Catalogue

A book of generous proportions and beautiful appearance is the new catalogue, entitled "Clay-Working Machinery" published by W. A. Riddell Company, the oldest and largest manufacturer of such machinery in the world. Although the book is written primarily for ceramic-plant operators, it describes many types of machinery, such as crushers, elevators, screens and fans, that are required by other pit-and-quarry plants.

Elverite Adopted as Trade Name

The Fuller Lehigh Company which, for many years, has specialized in chilled-iron castings, announces that, hereafter, its chilled products will be known as Elverite in tribute to the metallurgist of the company, J. S. Elverson. Exceptional training, experience and inherent talent combined in enabling him to develop, not accidentally to discover, the factors and treatments that are incorporated in the castings made by this company.

Mr. Elverson was born in Camden, New Jersey in 1865. He holds degrees of B. S. and E. M. from the University of Pennsylvania. During his career he has been engaged on a second geological survey of Pennsylvania, ore surveys in Pennsylvania and Virginia, as ore agent for the Crane Iron Works, as president of the Catasauqua Manufacturing Company, as manager of the Oxford mines and furnaces of the Empire Steel & Furnace Company, as president of the Lehigh Foundry Company, and as special agent of Naylor & Company.

Benjamin Dixn Advanced

Benjamin Dixn, who has been sales manager of the Industrial Works of Bay City, Michigan since 1900, is now connected with the Ohio Locomotive Crane Company in the capacity of district sales manager. He is in charge of the Detroit and Chicago offices with headquarters at Detroit.

New Lincoln Electrode

The Lincoln Electric Company is manufacturing the new Kathode welding electrode for the arc welding of mild steel and for cast-iron repair work. This electrode, it is claimed, has qualities heretofore lacking in the usual electrode. It is manufactured in stock lengths of 14 in. and 24 in. and, for protection during shipment, is packed in metal containers holding 50 lb. each.

Yale and Towne Acquires Stuebing Cowan Company

The Yale & Towne Manufacturing Company, maker of material-handling devices, has purchased the Stuebing Cowan Company of Cincinnati, Ohio. This purchase adds a complete line of single-lift and multiple-lift hand trucks. A large modern factory for the manufacture of hand-lift trucks and skid platforms is in process of construction.

The sales department will remain under the supervision of James C. Morgan, with Walter C. Stuebing as his assistant in charge of all truck sales, William Stuebing continuing as superintendent of the Cincinnati plant.

Manitowoc Dealer Appointments

The Manitowoc Engineering Works announces the following appointments for sales and servicing of Moore Speedcranes, shovels, draglines, trench-hoes and Buffalo-Manitowoc clamshell buckets: M. G. Hennessy Machinery Company, 1115 Boatmen's Bank Building, St. Louis, Missouri; Ohio Equipment Sales Company, Bedford, Ohio; Thos. J. Crowe, 124 South Walter Street, Albuquerque, New Mexico.

W. E. Harris Promoted

The Chas. C. Steward Machine Company of Birmingham, Alabama, is enlarging its elevating, conveying, screening and power-transmission department. W. E. Harris, who has had over twenty years experience in the design and manufacture of this type of equipment, will be in charge of this department. He was formerly with the Stephens-Adamson Manufacturing Company. The sales department will also be enlarged to cover the entire South.

New Beaumont Agents

The Beaumont Manufacturing Company, manufacturer of copper-steel bins, announces the appointment of J. W. Hemmerle as general manager of the bin and batcher division. Mr. Hemmerle was formerly with Blaw-

Knox Company and has been in this field for over twenty years. George E. Furnival will be his assistant.

The following eastern agents have also been appointed: Stuart M. Christhilf Company, Baltimore, Maryland; George E. Hoppe, Richmond, Virginia; Charles H. Ineson, Rochester, New York; B. W. Ranson, Detroit, Michigan; Brown and Sites Company, New York City (for export only), and Gesner Contractors' Equipment Company, New Haven, Connecticut.

Move California Offices

The American Hoist & Derrick Company, manufacturer of "American" hoisting machinery, announces the removal of its office from 139 Townsend Street, San Francisco, to 5515 Doyle Avenue, Emeryville, Oakland, California. Boyd Nixon will continue in charge.

Ingersoll-Rand Core Drills

The Ingersoll-Rand Company is distributing a 44-page illustrated booklet describing "Calyx" core drills. These are made with gasoline, steam or power drives in sizes varying from Class G-33, which will drill to depths of from 50 to 250 ft., with cores varying from 2½ to 5½ in. in diameter, to Class BCF, which will drill from 600 to 1,800 ft. with 3½ to 10¾ in. cores. Other units will drill a core as large as 36 in. and to a depth as great as 5,000 feet.

These drills are being used in the mining and quarrying industries for drilling pump columns, elevator shafts, mine-ventilation shafts, holes for wire-saw tension poles, testing the depth and quality of deposits, and many other similar uses. It is claimed that they will core any material that will stand up under the process. Such varied materials as clay, coal, slate, sandstone, limestone, marble, granite, jasper and corundum rock have been cored. The booklet also gives a detailed description of the methods used to obtain best results with these drills.

Hercules Motors Expands Plant Facilities

The Hercules Motors Corporation is planning another addition to its plant to provide facilities for increased production of internal-combustion engines. The plant will be enlarged more than 50 per cent and about 600 additional workmen will be required.

Approximately $500,000 will be spent for a new building and the installation of additional machinery and testing equipment. A 3½-acre tract adjoining the present plant has been acquired on which this new building, which will have 68,000 sq. ft. of floor space, is being built.

Pennsylvania Equipment Described

The Pennsylvania Pump & Compressor Company is distributing Bulletin No. 147 describing a complete line of single-stage, double-acting, straight-line air compressors and vacuum pumps. These have many features in common. All are of the straight-line, center-crank type and are made with flat or multi-rope belt, steam or direct-motor drives.

A rigid frame houses the driving parts, entirely enclosing them and providing the well for the lubrication system. Other features are removable phospor-bronze main-bearing bushings, connecting rods with solid eyes at both ends, short and rigid piston rods, visible oil-level gauges, aluminum oil guard, solid-hub wheels taper-fitted on the shafts, and counterweighted and air-cushioned valves.

Morris Pumps

The Morris Machine Works in Bulletin No. 20 describes a complete line of sand and dredging pumps and hydraulic dredge machinery. All types of pumps in both left-hand and right-hand drives and four different types of discharges are featured. These are made in sizes of from 3 to 20 in. with belt drives, direct-connected single or double cylinder and triple-expansion steam engines, chain-and-sprocket drives, direct-connected electric motors and direct-connected gasoline engines.

All these pumps are similar in that their frames are very heavy and that they have ample bearing surfaces. The pumps are hydraulically balanced for end thrust but have in addition a thrust bearing of ample size. A removable disc fitted on the suction side gives ready access to the interior of the pump. Considerable space in this bulletin is also devoted to a discussion of the use of these pumps for various purposes including sand-and-gravel dredging and hydraulic mining.

Bulletin No. 122 describes double-suction pumps with horizontally split casings for pumping water, sewage and similar liquids. These are also made in a wide range of sizes and drives.

Bulletin No. 123 describes water, sand, and dredging pumps in various sizes, types and drives, steam engines and complete dredging outfits. The last-named are built fully equipped and ready for operation, or the machinery is supplied with plans from which the dredges can be constructed.

Perfex Names New Secretary And Treasurer

D. T. MacLeod, president of the Perfex Corporation, manufacturers of heavy duty radiators, announces the promotion of John W. Tambert, who for nearly five years has been in charge of the cost and manufacturing departments, to the post of secretary and treasurer, taking the place of C. G. Phelps, who recently resigned.

G. W. Foote who has been appointed factory manager, was formerly with the Republic Metalware Company, where he was for many years general superintendent in charge of production, tools and maintenance. He was also formerly connected with Geuder, Paeschke & Frey, The Locomobile Company of America, The Lake Torpedo Boat Company and, during the late war, the Watertown Arsenal.

Electric Motor Drive For Underfeed Stokers

The Type E and Type K Underfeed Stokers, manufactured by Combustion Engineering Corporation, are usually steam driven. An electric motor drive has recently been developed which is applicable to either of these stokers and may be used wherever the steam drive is impractical, as for instance, where the operating steam pressure is below 60 lb. per sq. in.

The electric drive may be briefly described as follows: The drive consists of a double worm gear reduction unit and a Reeves variable speed transmission unit. The gear case assembly is compact. All parts are fully encased, yet readily accessible. The motor is located on the flat, top surface of the gear case which provides a convenient and solid support. In this position, the motor is well removed from the usual floor dirt of the boiler room and is out of the way when the floors are washed. Access to the fire doors is not hindered in any way.

American Hoist Appoints Cusac

The American Hoist & Derrick Company has appointed W. M. Cusac to the Chicago sales force. Mr. Cusac was formerly with the McMyler Interstate Company of Cleveland.

Diesel Engine Manufacturers Organize Association

With the rapid growth in the use of diesel engines in all types of industrial, public-utility and municipal service, as well as in the railway, automotive, aviation and marine fields, the manufacturers of diesel engines have realized the need for a closer contact with each other and with the problems of the user. As a result, a group of leading builders in the United States have organized the Diesel Engine Manufacturers' Association, which has, as its primary object, the advancement of diesel power in America and a broad program of cooperation with the users of this type of power.

Possibly the greatest benefit to the users of diesel power will come through the development of suitable standards of manufacturing and engineering practice. Such active problems as specifications for oil fuels, wider distribution of accepted fuels, and similar subjects will have the attention of the manufacturers.

It is also the intention to promote and extend the use of diesel power. In accomplishing this object more information will be made available on the application of diesel engines in all types of service. During the past few years there has been much definite progress in diesel-engine design. The manufacturers feel that the next most important step is to take greater advantage of the economics of diesel engines in all applications.

In the struggle to reduce production costs in all lines of manufacturing, power cost plays such an important part that the diesel engine is effecting marked savings. In the field of power distribution represented by the public-utility organizations, there is now a definite trend towards the use of diesel power. In this field it is expected that the diesel engine will play an increasingly important part as the years go by.

In marine service more than half of the tonnage now being built is equipped with diesel engines and in the work-boat field practically no other type of power is being used. The first airplanes equipped with diesel engines have recently completed very satisfactory test flights and a number of motor buses and trucks are being driven with this form of power.

Another outstanding application of the diesel engine is in railway service. The diesel locomotive's freedom from smoke, low operating cost and flexibility in operation have offered the same advantages as electrification without the high investment attendant on the use of that power. A number of these locomotives are already in operation on various railway systems in America.

Although Dr. Rudolph Diesel, a German engineer, is commonly given credit for the invention of the engine which bears his name, the first commercial installation was made in the United States in 1893. Not much progress was made from that time until about 1912, when a number of improvements again focused attention on this type of power. The progress since that time has been rapid, until to-day engines of more than 4,500,000 hp. are in marine and stationary service. Of this total, some 3,000,000 hp. is in the United States.

In addition to its low operating cost the diesel engine has the interesting characteristic of being just as efficient in small sizes as in large units. The largest engine to date is the 15,000-hp. unit installed in a German power station. Units of 5,000 to 8,000 hp. are becoming common in the marine field. It makes little difference, however, whether the engine is 50 or 10,000 hp., it has the same high efficiency.

Because of the simplicity of the diesel engine with its elimination of any kind of ignition system or carburetors, it has established some remarkable reliability records. Many instances have been recorded where diesel engines have operated continuously for more than a year without a single shut-down. Practically all the first diesel engines installed in the United States some twenty-five years ago are still in operation.

Diesel engines are attracting considerable attention in the pit and quarry industries, and installations of this type of power are becoming frequent. As their practicable service in the many ways in which power is required in these industries is demontrated, they are sure to be used more generally.

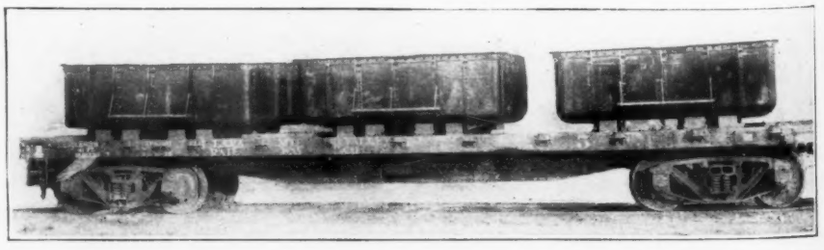
In addition to encouraging the wider use of this efficient prime mover, the manufacturers are also giving more attention to better diesel power-plant design. Although the diesel engine is a simple type of prime mover, its satisfactory operation depends on good plant layout. Cooling water and lubrication are especially important in this field and the layout of cooling-water systems has had considerable study. The use of lubricating-oil purifiers of various types and the development of completely automatic lubrication systems have eliminated difficulties in this phase of plant operation.

With all this increasing interest in diesel engines the manufacturers, through their Diesel Engine Manufacturers' Association, are filling an important need in making all sorts of information available to the public with respect to diesel engines and their operation.

The president of the association is Henry R. Sutphen, president, Electric Boat Company. E. T. Fishwick, vice-president of the Worthington Pump & Machinery Corporation, is vice-president of the association; and Harland A. Pratt, manager, oil and gas engine department of the Ingersoll-Rand Company, is secretary and treasurer. The association also employs M. J. Reed as research engineer, with headquarters at the association office, 30 Church Street, New York City.

Three Koppel Skips Mounted On Single Railroad Flat-Car

In the article published July 3 about the new plant of The Monolith Portland Midwest Company at Laramie, Wyoming, we described the twenty large railroad cars which transport the crude stone from the quarry to the plant, a distance of nine miles. These were well illustrated by two views, but the name of their manufacturer was inadvertently omitted. We reproduce another picture which shows one of these unusual cars from the closed sides of the three skips. These skips were furnished by the Koppel Industrial Car & Equipment Company.



One of Twenty Cars of Three 10-cu. yd. Skips Each That Transport Rock for Monolith Portland Midwest Company